

# Business Process Technology



Dirk Draheim

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A Unified View on Business Processes,  
Workflows and Enterprise Applications



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## Foreword

In the last decade there has been an explosion of interest in the modeling and automation of business processes, and competence in this area is seen as increasingly critical to business competitiveness and stability. However, this has led to a parallel explosion in solution approaches and technologies leading to a state-of-the-art that is highly disjointed and confused. In particular, there is a mismatch between business process modeling technologies on the one hand, which focus on allowing domain experts to describe business processes in a graphical, easy-to-use way, and workflow engines on the other hand which focus on automating the enactment of business processes in association with human users. Not only is there little consensus on concepts and terminology, there is also little connection between commercial solutions and established computer science theory. This is where Dirk Draheim's book makes its contribution. First, it clarifies the conceptual differences and similarities between the many different business process technologies available today and lays the foundation for a unified understanding of the field. Second, it explores the relationship between these technologies and traditional principles of computer science such as structured programming. And third, it lays out a vision for the future of business process technology and its optimal use in business process improvement and enterprise systems development.

Most books on business process technology either take a very broad but high-level view of the challenges and solutions in this area or provide a very detailed but narrow view of a specific issue or technology. It is rare to find a book that manages to do both. Dirk Draheim combines his experience with the wide-range of practical technologies currently used to automate business processes with his deep understanding of computing science formalisms to show how the former can be given a stronger theoretical foundation. Finally the best part of the book is saved until the end. In the final chapter Dirk Draheim proposes "Typed Workflow Charts" as a new formalism for modeling and automating business processes. This represents a genuinely innovative step forward which is likely to have a big impact on the way business processes are specified and automated in the future.



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## Author's Preface

Is it possible to specify business processes in a technology-independent and executable manner? That is the question this book addresses. There are different communities addressing business processes each with different objectives, tools and terminology – business process reengineering, business process modeling, task modeling, business process management, workflow management. We seek for a unified understanding of the phenomena addressed by these communities. There is a huge potential for automation in today's Enterprises. An integrated platform for specifying and controlling processes in an enterprise would be an enabling technology to use this potential. However, there are severe challenges that must be overcome before such a platform can be designed. First, there are structural frictions in today's business process modeling and today's business process implementations, i.e., lack of operational semantics and lack of a canonical implementation. Second, current business process management (BPM) and workflow technologies are not fully integrated with the application programs that implement the dialogues of an enterprise application.

Business process models do not have a precise operational semantics in the sense of a fixed set of rules that describe the state changes in the system under consideration. There is no canonical mapping between the activities of the business processes and the dialogues that support these activities. The workflow paradigm in its current form does not really help in this situation. Up to now, workflow technology is only really convincing in the field of document management. Current business process execution and management technologies arose as enterprise application integration technologies and they are still used in this manner. However, workflow technology is not yet a proven concept as a general enterprise resource management technology.

Today's BPM technology is successfully used in enterprise application projects in the following sense. As a first step the system analyst identifies the rules behind the interplay of existing enterprise applications. These rules are then automated by a BPM product. Today's BPM technology controls workflow states. However, it does not control the dialogues that bridge the workflow states – the dialogue states are not seen by BPM technology. This means,

most importantly, that the dialogues are also not amenable to advanced BPM tools and techniques like business process simulation and business process monitoring.

Furthermore, if BPM technology is used to build a workflow-intensive system from scratch it is not obvious any more how to design the human-computer interaction. The problem is to fix the right granularity of workflow states versus dialogue states. Despite some heuristics a systematic treatment of this question is still missing. We follow a different, more direct approach: workflow states and dialogue states are unified so that the aforementioned problem simply does not appear any more. This text aims at characterizing and mitigating the mentioned gaps. We target a seamless specification of workflows and dialogues.

### Objectives of the Book

We analyze the existing gap between business process modeling, which is a system analysis activity, and business process automation, which is related to system design. We also analyze the gaps and tension between current classes of business process technology, i.e., business process modeling tools, workflow definition, and integrated development environments. We claim that an analysis of the aforementioned gaps and tension is necessary before an integrated business process management platform can be designed. These are some of the discussions, questions, results and contributions of the book:

- We explain that business process management lifecycle models should be understood as pools of systematic activities and argue that they can hardly be interpreted as strictly staged models in Sect. 2.4.1.
- We propose a new model of IT ownership which cleanly separates foreseeable total costs of ownership and assessable total benefit of ownership in Sect. 2.6.4.
- We introduce a spiral quality management system model in Sect. 2.7 which is reductionist in terms of organizational functions but sophisticated in terms of interfaces between organizational functions.
- We identify three distinguishable aspects of component technology in Sect. 3.3, i.e., the sub industry aspect, the infrastructure aspect and the large system construction aspect.
- We explain why today's emerging CSCW tools should be exploited in business continuity management in Sect. 3.4.
- We propose the integration of business processes, production processes and business intelligence by the means of data warehousing technology in Sects. 3.6.2.
- We distinguish between a global view on workflows, which is the view of workflow supervisory, and a local view on workflows, which is the view of the single workers involved in workflow executions, in Sect. 4.1. It turns out that this distinction helps in the understanding of quality of design



of business process specifications and also helps in understanding the gap between business process modeling and business process automation.

- We report on the informality of business process modeling languages in Chapter 4 and why this informality is sometimes needed in projects. For example, we report on the semantic inconsistencies of how events are used in today's business process modeling languages in Sect. 4.4.
- We discuss the need for a means to specify arbitrary synchronization in business process models and workflow definitions in Sects. 4.6 and 9.2.10.
- We coin and define the term of a methodology stakeholder in Sect. 5.1. We explain the impact of methodology stakeholders on the software engineering practices of real-world projects.
- Throughout the text we foster a visualization independent viewpoint of business process specification and even more, i.e., a syntax independent viewpoint or to say it better a concrete syntax independent viewpoint – see, e.g., the discussion of abstract syntax in Sect. 5.1.3.
- We describe two different semantics of business processes with multiple start and end events in Sect. 5.2.2, i.e., a self-contained semantics and a global, context-embedded semantics. We describe that the selection of a self-contained semantics has an impact on the flexibility in building hierarchies and try to find an explanation why a self-contained semantics seems often to be preferred in practice.
- We identify the reasons why methodology stakeholders stuck to the guideline of single entry or exit points for business process specifications – see Sect. 5.2.3.
- A visualization-independent characterization of uniqueness of interface points – see Sect. 5.2.4.
- We observe that certain type specifications for data in leveled data flow diagrams are control flow constraints in Sect. 5.3.
- We investigate the opportunity of bringing the best practices of structured programming to the field of business process specification in Chapter 6. This attempt is done in a sophisticated manner. It is accompanied by a reconsideration of the arguments of structured programming in that we ideally target to identify the scientifically discussable core – in the sense of falsifiability [287, 288] – of the structure programming metaphor.
- We explain workflow systems from the viewpoint of human-computer interaction in Sect. 7. We explain workflow systems as three-staged human-computer interaction. On this basis we are able to distinguish between terminal/server-style and windows-style workflow systems and analyze their differences.
- We explain the importance of a general instead of pattern-oriented viewpoint on the assignment of resources to activities in workflow automation in Sect. 7.2.3.
- We identify four well-distinguishable visions for service-oriented architecture, i.e., the enterprise application integration vision, the business-to-business-vision, the flexible processes vision and eventually the software

productizing vision – see Sect. 8.1. This clean distinction can help in projects to identify and prioritize more quickly the actual targets of the different stakeholders who are advocating a service-oriented architecture strategy.

- We identify two different styles of service-oriented architecture for enterprise application architecture which are basically distinguished from each other by whether the service tier implements business logic and holds persistent data and coin the terms fat hub resp. thin hub hub-and-spoke architecture for these architectural styles – see Sect. 8.2.
- We give a characterization of SOA governance as an approach to massive software reuse – see Sect. 8.5.2
- We elaborate that software reuse can be distinguished from software use, i.e., that software reuse is the either a static use of arbitrary software or a dynamic use of multi-tenant software – see Sect. 8.5.3.
- We introduce the notion of a typed business process modeling. This approach has typed workflow charts as a basis which are integrated with a hierarchy of typed business process models – see Sects. 9.2 and 9.4. The analysis of leveled data flow diagrams in Chapter 5 lays the basis for the design of a concrete integrated typed business process platform.
- We introduce workflow charts and define their semantics in Sect. 9.2.2. Workflow charts are typed tripartite directed graphs. Workflow charts extend and generalize formcharts with respect to the needs of executable business process specification. This means that workflow charts resolve the research question posed in Sect. 3.2. Using workflow charts as a domain-specific programming language means closing today's gap in workflow definition and application programming.

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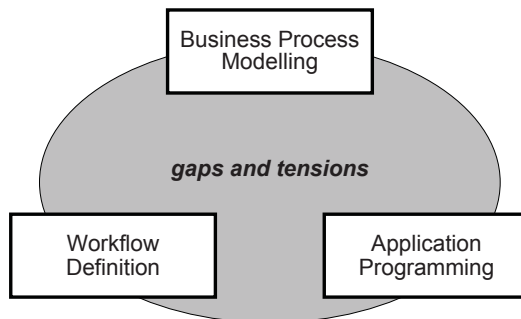


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## Introduction

The topic of this book is the gaps and tensions between the realms of business process modeling, workflow definition and application programming – see Fig. 1.1. The goal is to eventually realize fully integrated executable business process specification. In order to approach this goal, first the gaps and tensions between these three fields must be carefully analyzed. We clearly have a software engineering viewpoint on business processes, as you might guess from our choice of terminology in Fig. 1.1, i.e., business process modeling in favor of business process engineering, workflow definition in favor of the currently widely used term business process management, and application programming instead of enterprise applications. This means we have a focus on notation and its semantics.

But please pay attention! We neither neglect the business-related mission nor the technical issues of enterprise information technology. On the contrary, we believe that each purely language-oriented approach is likely to fail to overcome the problems that you are faced with if you aim to create a next generation business process platform. It is simply not enough to choose a lan-



**Fig. 1.1.** Gaps and tensions between business process modeling, workflow control and dialogue control.

guage that seems to be rich enough to describe business process phenomena and to define a mapping onto components of a programming technology. It is not enough, because there are plenty of subtle driving forces in the context that cannot be simply neglected. These driving forces are (i) non-formality of business process modeling, (ii) a certain kind of design orientation of application programming and (iii) a certain focus of today's workflow technology on enterprise application integration (EAI).

The activity of business process modeling has a business process optimization facet and a requirements elicitation facet. For neither of these two facets is specification completeness a necessity, which means, in particular, the business process descriptions in this area are usually far from being executable. The reason for this is simple: the languages and notations used here are not formal, i.e., they have no formal semantics as is the case for programming languages. It is wrong to judge this immediately as a flaw, there is also a reason for this. The languages and notations need only to be as accurate as needed for supporting tasks in business process optimization and not beyond. Note that too much accuracy is simply overhead here and can even hinder the creative activities in this field. Remember that business process optimization relies on activating and communicating know-how of business process experts, best-practices like strategic benchmarking or approaches to learning organizations. The same is true for requirement elicitation, here again complete accuracy is not necessary. This might puzzle you, because, specification completeness is usually considered an ideal for requirement specification, see, e.g., the characteristics of a good software requirements specification (SRS) listed in IEEE standard 830-1993 [169]. However, again completeness does not mean need for executability or formality. In practice a good, elaborated text document to which the different stakeholders have committed as a result of a requirement elicitation process is considered appropriate.

## 1.1 Relevance of Business Process Technology

Business process technologies are clearly a major issue in information technology projects in today's enterprises. For example, in 2005 business process management suites were at the peak of inflated expectations in the Gartner hype cycle report for emerging technologies [126, 125]. Being at the peak is telling, however, alone the fact that business process management suites are among the technologies investigated in the report indicates the importance of the topic for business stakeholders; actually, the technologies considered in the hype cycle report span a wide range including, e.g., DNA logic and handwriting recognition.

Moreover, also the topic of business process platforms is among the investigated topics of the hype cycle providing further evidence for the importance of business process management. From a vendor's viewpoint a business process platform is a business process management suite that ships with

commercial off-the-shelf components for a certain domain. From a more conceptual viewpoint business process platform technologies go beyond business process management suites in that they define a component model for hooking workflow-based application parts into a business process management technology, most likely in terms of service-orientation, because service-oriented architecture (SOA) is the current trend of component-orientation in the realm of enterprise computing. So, business process platforms are a vendor's answer to the increased need for flexibility and adaptivity in business process management.

Also, a glimpse at the seventh framework program (FP7) of the European Union [123] shows that the scientific community is also very well aware of the impact of innovative business process management solutions: "ICT in support of the networked enterprise" is an objective of FP7 and one of the target outcomes of this objective are "tools and technologies that enable intra-enterprise collaboration and the definition and execution of tasks and workflows for operation across multiple domains" [123].

### **On the Role of Business Processes in an Enterprise**

Basically, we have seen four large schools of management in the last century. The classic Taylorism [339, 340, 341] was a systematic work-organizational approach, a school of improvement of processes. Taylorism was overcome later by human-resource orientation [19], followed by a mathematical school or operations research [253] and systemics or cybernetics [21, 22, 23, 234] eventually. Business process orientation in its concrete forms of business process reengineering and business process management entered the stage in the 1990s and still has major impact on enterprises and enterprise technologies. So, is business process orientation a fifth school of management or is it only an implementing discipline or even less, just a terminology? Some would say that business orientation is a revival of Taylorism, others would say that it starts where Taylorism has ended and develops it further by bringing a more holistic, organizational viewpoint to it. However, it is a fact that many successful enterprises are oriented towards business processes today. You can find business process orientation implicitly in today's established quality management approaches. You can find business process orientation explicitly in concrete projects that exploit one of the known business process disciplines or technologies.

Excellent enterprises are managed in an excellent way. Management is about strategic planning and the management of operations. Management of operations is about planning, organization, coordination and control [124]. The management of operations is about the management of business processes. Planning and organization provide the resources and create the structures that enable an efficient functioning of the business processes. Coordination and control of daily operations provide business process execution and business process monitoring. Today's quality management systems like ISO 9000 are

business process oriented. If a quality management system is well-established in an enterprise it is not just an auxiliary function. A quality management system can become so pervasive in an enterprise that it forms the central pillar of the management system of the enterprise. Quality management systems are based on a notion of business process management lifecycle. The key performance indicators that drive the business process management lifecycle of a quality management system are specified and analyzed in terms of the defined business processes of an enterprise.

The enterprise resources form the hardware of the enterprise. The business processes are the software of the enterprise. The management of an enterprise has a central interest in business process definition. In daily operations the work is not necessarily transparent, i.e., it is not necessarily following fixed rules and processes. Work can be done in an ad-hoc manner, it can be based on routine and word-of-mouth knowledge. It often needs significant efforts to make the functioning of an enterprise more transparent. Business process documentation is the first step in a business process definition project that targets a systematization of daily operations. Actually, business process documentation alone already causes a power shift to the management of an enterprise. Knowledge about how things are done in an enterprise is a crucial element of power. The more the managers know about how employees reach their targets, the more they will conceptually decouple people from their tasks, i.e., the more concrete stakeholders will become substitutable and therefore less important in the company. Therefore, it is often possible to encounter significant resistance when a business process definition project is executed. Often, business process projects must be conducted as change processes with a systematic organizational change management.

## **Establishing Business Process Technology**

Business process technologies comprise tools to analyze, document, specify, monitor, simulate, support and implement business processes – see also Fig. 9.1. It is the role of business processes and process orientation in today's enterprises that makes business process technology so important. Further evidence for the significance of business process technology is given for us by the concrete business process technology related projects that we see in industry, in particular, by our own experience in projects with industrial partners. We guess that business process technology is an issue in one form or another in each enterprise of a certain size. Somehow, industrial stakeholders approach business process technology either top-down or bottom-up. The top-down approach is a rather strategic one. It is driven by the desire for a general, i.e., enterprise-wide information technology reorganization or business process reorganization. The bottom-up approach is usually technology-driven, i.e., the need for local improvements in an enterprise IT landscape force stakeholders to look for appropriate products available to improve the situation. Therefore there are forced to look into state-of-the-art concepts that these products are

based on – possibly resulting in a change of mind set. This impact alone but also some tight coupling of the concerned system with other systems of the enterprise can yield to a domino effect onto the surrounding system landscape, likely triggering the decision to proceed rather top-down eventually.

Often, the usage of concrete business process technology emerges step by step over the years by the need of continuous improvement of support for the business processes of an enterprise. Often, there is also need for explicit projects related to business process technology. We have conducted ourselves a couple of such projects, e.g., with logistics providers, banks and insurance companies. Such explicit business process projects can have the task to bring together business process modeling activities with software engineering activities for business-process applications, to select a concrete business process management technology, to test the maturity of a concrete business process management technology, to answer a concrete question in business process definition, to design the human-computer interaction of a workflow-intensive system or to define a software component architecture for a concrete business-process application. The experience from these projects strengthen our opinion that, on the on hand side, business process technology is here to stay and that, on the other hand side, there is still a potential to improve business process technology significantly.

### **Beyond Business Process Management and Technology**

Management is a complex and heterogeneous function in an enterprise. A first attempt at systematization of management tasks is usually to consider different levels of management that somehow correspond to levels in the organizational hierarchy, e.g., a strategic level, a tactical level and an operational level. For the sake of the following discussion we want to draw the reader's attention to three other different categories of management that we see in today's enterprises, i.e., business process management, project management [291] and knowledge management [233, 334]. These three kinds of management coexist in an enterprise. The operational level, i.e., the level of daily operations, is the domain of business process management. The more you move up the levels in the organization chart, the less work will be defined in terms of processes. Also at the lower levels of an organization there is a lot of work that is not amenable to business process management. For example, the work in an R&D department (research and development department) is a creative task that is often hard to define and hard to understand. The correct management approach for a creative R&D department might be what is known as the 'laissez faire' approach to management.

Business process management is about processes that are started over and over again in order to achieve a defined business objective. Like business processes projects are also defined forms of work undertaken by people in an enterprise to achieve a goal. However, projects are temporary and unique. You could say that a project can also be considered as the single instance of a

business process. Sometimes, projects are repeated, so then they are actually not really unique any more. But this is only an artificial discussion. Projects are different from business processes. They are planned, staffed and controlled in a different manner. For example, projects are always managed by project managers, whereas there are not necessarily explicit business process managers in an enterprise that runs defined business processes. However, there is a potential for unification of business process management and project management practices and tools in the future. Knowledge management is about the systematization of know-how in an enterprise. Knowledge management is not the opposite of business process management; it is orthogonal to business process management. Business processes also embody a form of knowledge. Defined business processes are accompanied by additional knowledge that might not be amenable to a definition as business processes.

The main topic of this book is the integration of business process modeling, workflow definition and system dialogue programming in future business process management platform. Beyond that, there is a potential in integrating practices and tools for business process management, project management and knowledge management. The proposed exploitation of Web 2.0. technology for business continuity management in Sect. 3.4 and the envisioned integration of production processes, business processes and business intelligence in the domain of manufacturing in Sects.3.5 and 3.6 are instances of this potential.

## 1.2 Need for Flexible Business Process Technology

Today's enterprises must react to new customer demands in highly competitive markets. Due to the globalization of markets with its new opportunities and threats enterprises must be able to react even more quickly. Information technology plays a pivotal role in making enterprises more flexible. We will talk about information technology as a mission-critical asset also later in Sect. 2.6.

With respect to flexible information technology, there are two sides to the story. You can understand improvements to flexibility as an introduction of new innovative functionality that speeds up the business process management lifecycle – for a discussion of the business process management and the business process management lifecycle, in particular, please have a look at Sects. 2.4 resp. 2.4.1. Capabilities for monitoring and analyzing running processes belong to such functionality that goes beyond IT support for processes of daily operations. And stakeholders feel the same about tools that help to model and execute processes more precisely and faster. This means that in the efforts of top management to make the enterprise more agile, i.e., more reactive, the application of new innovative technology is considered.

However, also the different perspective is important. Often, the IT system architecture in an enterprise is experienced as inflexible, i.e., hard to maintain and change. Sometimes, the processes of an enterprise seem to be hard-wired



in the software applications of the enterprise. Often, they are not explicitly documented, but rather given by the way staff works with the software applications that support the business processes. A first step in changing the processes of an enterprise is then an ‘as is’-analysis of the IT systems of the enterprise and the way they support the business processes of the enterprise. A concrete problem in large enterprises is that the several functional units, e.g., the several departments of the enterprise, each may have their own specific IT support. Then, support for cross-functional processes is often poor; technologically it is about enterprise application integration. In such cases the flexibility of the overall IT support of the enterprise suffers, simply because of the complexity of the underlying overall system architecture.

### 1.3 Outline of the Book

In Chapter 2 we set the stage by describing why and how enterprises strive for business process excellence. We explain widely known business process disciplines, i.e., business process reengineering, business process optimization, business process management and business continuity management. We make an attempt to explain the differences and relationships between these disciplines. However, the more important target of Chapter 2 is to strengthen the reader’s awareness for business process excellence and its role for today’s enterprises. Furthermore, the chapter explains the importance of information technology for achieving business process excellence. The striving for business process excellence and the importance of business process technology is the background against which all the other chapters of the book have to be understood.

There is still a huge potential for research in business process technologies. This is so with respect to R&D, i.e., research and development activities which target new innovative products with as little time-to-market as possible. But it is also true with respect to more basic research activities with long-term research goals. In Chapter 3 we identify and describe two basic fields that open research opportunities in business process technology, i.e., executable specification and component technology. Future business process platforms will combine executable specification with new concepts of component technology.

There are three kinds of management in modern enterprises, i.e., business process management, project management and knowledge management. We believe that there is a potential to design tools that offer integrated support for these different styles of management. In a first step these tools will be no general-purpose tools, but domain-specific. As an example for such integrated management platforms we envision the usage of social software for business continuity management. As another example for this principle we describe the design of an industrial information backbone that integrates the fast production processes with the slower production planning processes and strategic decision processes.

In Chapter 4 we look at the informality of business process analysis and business process modeling. Is the informality of business process modeling a flaw that should be overcome or is it necessary to stay agile in top-level system analysis? Is there a sweet spot between informality and agility? We try to explain why concrete business process modeling language constructs that are widely used today are not formal even if they appear as being formal. With an understanding of informalities in business process modeling pitfalls can be avoided and modeling languages can be used to their best potential without the typical natural diffidence. The insight presented in Chapter 4 can be exploited in projects where general business process models coexist with specific executable business process specifications, i.e., workflow definitions. It can also be exploited in the design of integrated business process platforms. We have a concrete look at the ambiguities of the usage of events in typical, state-of-the-art business process modeling projects. We discuss the need for a mechanism to specify arbitrary synchronization phenomena in business process modeling.

This means that Chapter 4 addresses the vertical gap and vertical tensions between business process modeling, on the one hand, and workflow definition and application programming, on the other hand, that have been illustrated in Fig. 1.1. And so do Chapters 5 and 6. Chapter 5 is about the decomposition of business process specifications. We treat decomposition of business process specifications by considering leveled data flow diagrams. The principles and issues in decomposing business process specifications are basically the same for business process specifications in general and executable business process specifications in particular. A key issue in leveled data flow diagrams is that the operational behavior of a system can usually only be understood by the finest level of diagrams in the hierarchy. There is a loss of information with respect to the operational behavior while moving upwards the hierarchy. This is so for hierarchies built on top of a flat business process analysis model and those built on top of executable business process models. Furthermore, we analyze, on the one hand side, the parallel decomposition of activities, transitions and data and, on the other hand side, the parallel decomposition of activities, transitions and control flow constraints.

In Chapter 6 we investigate in how far a structured approach can be applied to business process modeling. In doing so, we try to contribute to a better understanding of the driving forces on business process specifications. The chapter shows that a structured approach can not be applied to business process modeling without care. Business process specifications are fundamentally different from computer programs. In computer programming the structured approach is well established. The crucial difference is that a computer program can be restructured in order to achieve a better design in whatever sense without changing the semantics of the computer program which is a functional transformation. However, business processes express a behavior and have an observational semantics. Therefore, they do not offer the same degree of re-

structuring. It is the task of Chapter 6 to characterize this fact and analyze it further.

Chapter 7 and Chapter 8 are about the implementation level of business processes. Chapter 7 analyzes workflow technology. We take a human-computer interaction viewpoint in characterizing workflow management systems. We explain how current workflow technology orchestrates applications and programs that implement system dialogues. This way, the vertical gap between workflow definition and application programming as visualized in Fig. 1.1 is implicitly explained. We also have a look at the assignment of actors to tasks in workflow technologies. Here, we are not interested too much in concrete IT product features and concrete role models. We are interested in a basic understanding of the assignment of actors to tasks. Chapter 8 deals with component technology for programs that implement workflow-based systems. It does so by discussing the emergence of service-oriented architecture. If you do not insist on a concrete definitions of component technology, in particular, on such that need the object-orientated programming paradigm as a basis, it is fair to say that service-oriented architecture is today's leading component approach in the field of business process technology. Again, we have a look at how current workflow technology orchestrates applications and programs in Sect. 8.4.1 – see also Fig 8.5 – this time from the perspective of exploiting concrete web services technologies for building business process management suites.

Chapter 9 provides the conclusion. It summarizes some of the major insights of the book. For example, it once more discusses a distinction between business process modeling and workflow definition languages. However, it goes beyond a mere summary by eventually describing the notion of typed business process modeling and, even more concrete, introducing a three-staged workflow definition language – so called workflow charts. Workflow charts can be exploited as executable business process models; they can be considered the top-level syntactical structure of a domain-specific high-level programming language for business process execution.

## Business Process Excellence

Businesses are made of processes. Enterprises strive for excellence in business processes. Different stakeholders perceive the topic of business processes differently. You can approach business processes either from a strategic viewpoint or a technical viewpoint. This, in the first place, means that business processes as an object of investigation are so complex that whole sub-communities formed to address the topic appropriately. Strategic issues and IT issues are eventually intertwined if you conduct a business process improvement project. Business processes are supported by IT in today's enterprises, so if your target is to improve business processes of an enterprise you are usually immediately involved in IT issues.

In this chapter we present the strategic view of business processes. We have seen and still see massive business process reengineering efforts in enterprises. Business process reengineering (BPR) [151, 150] is by far not only about business process optimization or business process redesign. It is a management issue, actually, it is a top management issue. Business process reengineering is a paradigm at the level of organizational structure, so it is about business reengineering, and usually about reengineering of large enterprises, i.e., corporate reengineering. After introducing business process reengineering and discussing its intention we will have a look at concrete opportunities to improve processes. Knowing about the motivation of business process improvement and learning about concrete examples of business process optimization is a good start, however, in concrete process improvement projects a systematic approach is needed to proceed successfully. With business process benchmarking we have a concrete approach for this at hand.

A further topic in this chapter is systematic business process management. Business process management is about a group of activities that make the business processes of an enterprise the subject of continuous investigation and improvement – it consists of the definition, execution, monitoring and optimization of business processes. If you set business process management into relationship with business process reengineering, you can see it from two sides. On the one hand, it can be seen as the result of decisions made during

business process reengineering being responsible for the fine-tuning of business processes in daily operations. On the other hand, it can be seen as a tool for ongoing, continuous business process reengineering. In practice, taking one of these two viewpoints determines whether business process management has rather a tactical or strategic emphasis in an enterprise. In any case, the analysis of benefits of business process management and possible impacts in general is not part of business process management itself, it really belongs to strategic efforts outside business process management.

Finally we need to discuss the strategic role of information technology (IT). Information technology is at the heart of the modern enterprise. As a crosscutting concern it empowers the enterprise both in house and in its context – the competitive market and the hosting society. Furthermore, there is often potential for improving business processes without exploitation of information technology. But usually concrete improvements are enabled by information technology. Information technology can support business processes directly and indirectly by empowering management and reengineering efforts. Once the importance of information technology for business process reengineering and management is recognized and taken for granted, these topics can be discussed independently of technology. However, eventually when it comes to the implementation of reengineering results and the establishment of business process management, concrete information technology must be chosen.

The explanation of business process reengineering, optimization, benchmarking, management and the enabling IT from a strategic viewpoint sets the stage for the discussion of business process technologies like workflow products and business process modeling languages and tools. Advances in these technologies must eventually address business process optimization. What we are seeking are such advancements that make IT systems flexible and integrative. Here, flexibility means a significant reduction of costs for the redefinition and construction of enterprise IT systems compared to today's technologies, so that there is an observable impact on the reactivity of business process management. Another strand of advancement is towards pervasive integration, i.e., the availability of all information emerging in an enterprise in all potential processes.

## 2.1 Business Process Reengineering

In order to give an impression of what business process reengineering is about we explain it from the viewpoint of business reorganization first. Later, in Sect. 2.2 we will discuss typical reengineering patterns. These patterns make clear that business process reengineering is not merely about reorganization; it is about migration to process-oriented structures – having reorganization often as a typical result. In a traditional structure the units of the corporation are functional business units, i.e., marketing, production, procurement, sales, accounting, human resources, research and development. Now, large compa-

nies offer several products and several services. So business processes crosscut the functional units of a traditional hierarchy. This is where business process reengineering can start. It is about changing the focus to the business processes. It proposes to ask for new organizational structures that eventually enable continuous business process optimization. For example, it would be possible to radically change the organizational structure and make the main processes the top-level units of the enterprise. Now, the managers of the resulting units are no longer department managers or area managers, instead they are process managers in charge of the outcome of one process. Before such a restructuring each of the units was involved in each of the crosscutting processes. This means responsibility was spread with the risk of overhead and not exploiting potential specialization.

Now, after making the main processes top-level units, each of the units reflects the former hierarchical structure inside, i.e., having groups for the various functions. In this way, the functions can be specialized and optimized by streamlining them to activities that add value. Such reorganization can already make sense for small and medium enterprises (SMEs). For example, imagine a small software development and IT consulting company that is organized as a number of profit centers. Now, having a top-level sales department neighboring the profit centers would most likely be an anti-pattern. Usually, it would be more appropriate to have sales persons in each of the profit centers for obvious reasons. However, in general there is no evidence that a process-oriented reorganization of an enterprise makes it perform better, because one has to admit that one may also observe counter effects. Before the restructuring, the process responsibilities were spread over several units, now responsibilities for the major business functions are spread over different units with potentially similar drawbacks – in a traditional hierarchy the know-how with respect to a function is gathered and improved over years in a central unit. At least, it seems to be self-evident that with respect to continuous process optimization the process-oriented organization is the correct choice.

### **2.1.1 Strategic Nature of Business Process Reengineering**

The business process reengineering paradigm as introduced in [151] was a radical approach from the beginning, foreseeing a business revolution. For example, it is emphasized that business process reengineering is not reorganizing, and it is not restructuring. Instead, it is really about creating a fundamentally new work organization in the enterprise. However, in practice, process orientation often evolves in enterprises in a step-wise fashion resulting in matrix-like structures having designated stakeholders on a more or less equal level for both functions and processes. Here, in this book, it is important to understand that business process engineering is a holistic effort that aims to empower the enterprise for process improvement.