Chapter No. 2

"Modeling Business Processes for SOA"
In this package, you will find:

A Biography of the authors of the book
A preview chapter from the book, Chapter NO.2 "Modeling Business Processes for SOA"
A synopsis of the book’s content
Information on where to buy this book

About the Authors

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Matjaz has been involved in several large-scale projects. He has been a consultant for several large companies on SOA projects. In cooperation with the IBM Java Technology Centre, he worked on performance analysis and optimization of RMI-IIOP, an integral part of the Java platform. Matjaz is also a member of the BPEL Advisory Board.

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My efforts in this book are dedicated to my family. Special thanks to my dear beautiful Ana. Thanks to my friends at Packt Publishing and University of Maribor and to Ales Frece.
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As a recognized Public Speaker, Kapil is known for his well-researched programs delivered in his high-energy, enthusiastic, and down-to-earth style. He has presented keynote speeches, workshops, seminars, and over 40 road-shows across the Asia Pacific, Europe and the USA. He was also nominated by the Government of India to lead seminars as a part of a 25-member working committee for E-Governance Enterprise Architecture and Standards Taxonomy.

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Business Process Driven SOA using BPMN and BPEL

Modeling business processes for SOA and developing end-to-end IT support for these processes have become top IT priorities for many organisation. The SOA approach is based services and on processes. Processes are focused on composition of services and in that sense services become process activities.

Experience has shown that the implementation and the optimization of processes are the most important factors in the success of SOA projects. SOA is so valuable to businesses because it enables process optimization. In order to optimize processes, we need to know which processes are relevant and we have to understand them – something that cannot be done without business process modeling. There is a major problem with this approach – a semantic gap between the process model and the applications.

This book will show you how to bridge this gap. It describes a pragmatic approach to business process modeling using the Business Process Modeling Notation (BPMN) and the automatic mapping of BPMN to the Business Process Execution Language (BPEL), which is the de-facto standard for executing business processes in SOA. The book will also cover related technologies such as Business Rules Management and Business Activity Monitoring, which play a pivotal role in achieving closed-loop Business Process Management.

What This Book Covers

Chapter 1 looks at the relation between SOA and business processes. SOA provides the technology platform for the implementation of business processes, and the development of applications that provide end-to-end support for business processes. This chapter also covers the long-term association of SOA with business processes and BPM.

Chapter 2 gives an overview of the role of business process modeling for SOA. It outlines the importance of BPM and its life-cycle, which consists of business process design, process implementation, process execution and control, and process optimization. It discusses each of these stages in brief. It also briefly discusses ARIS the methodology, BPMN notations, and process simulation.

Chapter 3 covers the concepts of business process modeling, and the use of BPMN as a standard in providing a consistent, process vocabulary to any business. It discusses the essential components of BPMN using some examples, which will enable you to start creating BPDs. It also introduces the Oracle Business Process Analysis Suite.

Chapter 4 addresses some general guidelines for process modeling before taking a deep dive into some complex constructs of BPMN, especially the length and breadth of Events, and the role they play in creating and visualizing BPDs. It also covers support for workflow patterns in BPMN and their use during process execution using BPEL.

Chapter 5 covers two important aspects in the BPM process: process analysis using simulation and process transformation for implementation. It emphasizes the importance of tools to extend support for some of the gaps in the current standards and transformation to reduce the issues of synchronization and process round-trips.

Chapter 6 covers business process modeling using BPMN and process analysis using simulation techniques. It covers process transition from BPMN to BPEL, followed by process orchestration and execution using process engines such as Oracle's BPEL Process Manager. It also evaluates some of the best practices for implementing various technology components to make the end-to-end process of BPM and SOA seamless.

Modeling Business Processes for SOA

Modeling business processes is a part of the overall business process management. **Business process management (BPM)** is a very important discipline, which is closely related to the operating efficiency and competitive position of a company, and its ability to grow. Business processes are also very well connected with IT. Today, IT is the driver of business processes. Imagine how any company would operate if the IT system is turned off for a week or even a day. You will quickly see that IT has become the engine that drives business processes.

SOA provides huge opportunities to better align business processes with IT and applications. To be able to achieve this, we have to understand the role of business process modeling and BPM in SOA.

In this chapter, we will:

- Discuss the role of SOA and BPM, and understand the business process life cycle
- Focus on business process modeling for SOA and discuss the methodologies and notations used
- Understand the process design and the results of process design such as process map, roles, relations, and so on
- Discuss process simulation
- Understand modeling principles
- Identify common problems in process modeling
- Discuss the process implementation phase and understand the role of SOA
- See an overview of process execution and control
- Discuss Business Activity Monitoring (BAM)
- Briefly discuss process optimization, key performance indicators, and typical problems in process optimization
Business Process Management

Achieving the highest level of efficiency in terms of time and cost in performing any business activity has been the guiding principle of successful businesses for a long time. In 1911, Frederick Winslow Taylor, the father of scientific management, published the following four principles of scientific management:

- Replace rule-of-thumb work methods with methods based on a scientific study of the tasks
- Scientifically select, train, and develop each employee rather than leave them to train themselves
- Provide detailed instructions and supervise how each worker performs in his or her discrete task
- Divide work equally between managers and workers, so that the managers apply scientific management principles to plan the work, and the workers actually perform the tasks

These ideas of sequencing tasks and allocating them to workers to produce results with business values are known today as business processes.

Taylor defined ideas precisely on how to implement business processes efficiently. His belief was that this is possible only through enforced standardization of methods, adoption of best practices and working conditions, and cooperation.

Today, these thoughts are grouped under BPM, which is a method for aligning a business organization with the needs of its clients. BPM fosters business effectiveness and efficiency while striving for innovation, flexibility, and integration with technology. The major objective of BPM is to continuously improve the processes, both within the company and with other companies (such as in supply chain management).

IT and BPM

As companies started to use IT to automate tasks and make work more efficient, IT started to influence business processes. To understand this, let us briefly elaborate on how IT was used in companies to automate tasks. The simplest usage of IT was the automation of simple tasks such as sending invoices or other documents by email rather than over fax or mail, calculating interest, getting stock information on different products, and so on. However, such simple automation influenced only distinct business activities and not the business processes as a whole.

Soon it was recognized that the role of IT could be larger than just automation of business tasks. IT could provide support for all business processes. Once IT became more integrated into business processes, three important things happened:
1. IT could not be considered just as system and data anymore. It had become a central element of business processes.

2. With IT’s support for business processes, it became apparent that IT influenced processes. This made more sense, if business processes changed — they could be re-engineered at the same time they were supported by IT technologies. In this way the value of IT could be better leveraged.

3. IT also opened new opportunities in public business processes (those processes that spanned several companies such as supply chain), and in global processes.

The facts mentioned here have, together with changes in global economy (which in turn required changes in companies), resulted in an increased awareness of the value of business processes.

Interestingly, in many companies, awareness of the value of business processes has been most evident in the IT departments. Sometimes, IT departments have a better understanding of the value of business processes and design than the management. This is in contrast to "common sense" and the findings of professionals such as Taylor. Instead of discussing whether this is appropriate or not, let us think about the new opportunities for IT departments to evolve from technology centers to the most important core of each company: innovation centers.

To be able to understand business processes and improve them, it is first necessary to understand how the existing processes work. Hence, it is necessary to develop the as-is model of business processes. Developing the as-is model is also called business process modeling. Only when we understand how business processes work, can we carry out the following steps:

- Develop applications that provide end-to-end support for business processes
- Optimize business processes to make them better

Of course, it is not necessary to perform these two tasks sequentially. We can optimize some processes and then develop applications. Alternatively, we can even develop applications and optimize processes in parallel. It is particularly important to understand that business processes are not static. Business processes evolve over time because companies have to adapt and change the way they perform business operations in order to stay competitive.

Finally, IT opens new perspectives for business opportunities. This way, it can be seen as a catalyst of new, innovative business processes, which can open new customer channels, define innovative ways to collaborate with business partners, and use IT for establishing better connections with customers, and sensing their wishes.
To sum it up, the role of IT in business processes is three-fold. It can be used for:

- Automation of tasks and activities
- End-to-end automation of business processes
- Definition of innovative business processes that leverage the IT technologies in new ways

**SOA and BPM**

The SOA approach provides huge benefits in BPM. In older IT architectures, the business processes and applications were not linked together. Business processes were "nice drawings", and applications very complex and resistant to change. If the process needed to change, which was quite often, it took a very long time to adapt all applications. The SOA approach provides huge savings as applications are much better aligned with business processes. This reduces the time required for adoption and makes the IT system more flexible.

With this flexibility, another common problem is solved. Optimizing business processes means changing them. Changes in business processes are directly related to changes to the tasks of those employees that are involved with the processes. The fact, however, remains that people do not like changes.

In the traditional approach to business processes optimization, projects have often failed because people tried to carry out very large modifications of several processes all at once. This resulted in resistance to changes. A joke says that if a business process change doesn't make at least three people angry, it is not a change. The reason for making large changes to processes is obvious—it is easier to develop IT system for the final state of business processes than to modify the system each time a process changes.

SOA flexibility, on the other hand, enables modifications to business processes to be done in small steps. This enables a much easier and more natural evolution of processes from the **as-is** state to the **to-be** state. With step-by-step transitions, IT can follow without a lot of effort and time delays.

Such a systematic approach also introduces another benefit. Optimizing processes step-by-step allows us to gather feedback on implemented changes and adapt processes to real needs. Therefore, it is more likely that the to-be processes will be really useful and efficient, than if we take a huge step from the as-is to the to-be process model.
Business Process Lifecycle

So far, we have seen that business processes are dynamic. To express the various stages of the, the business process life cycle has to be defined. A business process lifecycle has to cover the following four phases:

1. Process modeling is related to the definition of the process model, using the selected methodology and the notation.
2. Process implementation is related to the activities required to implement end-to-end IT support for the process. SOA provides technologies and tools to make the implementations phase quick and efficient.
3. Process execution and control is related to the actual running of the process, and the supervisors controlling the process execution and taking necessary corrective actions.
4. Process monitoring and optimization is related to gathering data about the process execution. SOA approach provides the ability to gather real-time quantitative data using process monitoring or BAM tools. Optimization is responsible for interpreting these monitoring numbers and identifying optimization points.

The following figure shows how a process enters this circle and goes through various stages:
Process modeling is the phase where process analysts, together with process owners, analyze the business process and define the process model. They define the activity flow, the information flow, roles, and business documents. They also define business policies and constraints, business rules, and performance measures. Performance measures are often called Key Performance Indicators (KPI). Examples of KPIs include activity turn-around time, activity cost, and so on.

Process implementation is the phase where IT developers (SOA developers), together with process analysts, implement the business process with an objective of providing end-to-end support for the process using IT (applications). The process implementation phase using the SOA approach includes process implementation with BPEL and process decomposition into the services, identification of service, implementation or re-use of services, and integration.

Process execution and control is the actual execution phase, where the process participants execute the various activities of the process. For end-to-end support in business processes, it is very important that IT drives the process and directs process participants to execute activities—and not vice versa, where the actual process drivers are employees. An important part of this phase is process control, where process supervisors or process managers monitor whether the process is executing optimally. If delays occur, exceptions arise, resources are unavailable, or some other anomalies occur, process supervisors or managers can take corrective actions.

Process monitoring and optimization is the final and a very important phase. In this phase, process owners monitor the KPIs of the process. Process analysts, process owners, process supervisors, and key users examine the process and analyze the process execution metrics. They also need to take into account the changing business conditions. They examine business issues and identify ways to improve the business processes to eliminate these issues.

Once optimizations have been identified and selected, the process returns to the modeling phase to apply them. Then the process is re-implemented, and the whole lifecycle is repeated. We talk about an iterative-incremental lifecycle, because the process is improved in each stage.

**BPM and SOA—A Perfect Fit for the Lifecycle**

We have seen that business processes are dynamic and that they need to be changed quite often. As today’s business processes are supported by IT, this also requires that the appropriate IT support is developed and/or changed.
With its direct support for business processes, SOA is a perfect fit for BPM. It enables quick and efficient development of applications that provide end-to-end support for business processes. SOA also provides the means to execute, control, and monitor business processes. BPM with SOA can therefore be used to support the full process lifecycle.

BPM and SOA enable business agility, as shown in the following figure:

As we can see from the above figure, SOA has a crucial role in the:

- Process implementation phase
- Process execution and control phase

We will talk more about these phases later in this chapter, and also in the rest of the book.
Business Process Modeling

In the business process modeling phase, the main objective is to develop the process model, which will define the existing process flow in detail. The transparency of the process flow is crucial, as this gives the process owners, process analysts, and all others involved an insight into what is going on. An understanding of the as-is process flow also ensures that we can judge the efficiency and the quality of the process.

The main objective of process modeling is the definition of the as-is process flow. Process modeling needs to answer the following questions:

- What is the outcome of the business process?
- What activities are performed within the business process?
- What is the order of activities?
- Who performs the activities?
- Which business documents are exchanged within the process?
- How foolproof is the process, and how can it be extended in the future?

After answering these and some other questions, we get a good insight into how the process works. We can also identify structural, organizational, and technological weak points and even bottlenecks, and identify potential improvements to the process.

We will model business process to satisfy the following objectives:

- To specify the exact result of the business process, and to understand the business value of this result.
- To understand the activities of the business process. Knowing the exact tasks and activities that have to be performed is crucial to understanding the details of the process.
- To understand the order of activities. Activities can be performed in sequence or in parallel, which can help improve the overall time required to fulfill a business process. Activities can be short-running or long-running.
- To understand the responsibilities, to identify (and later supervise) who is responsible for which activities and tasks.
- To understand the utilization of resources consumed in the business process. Knowing who uses which resources can help improve the utilization of resources as resource requirements can be planned for and optimized.
- To understand the relationship between people involved in the processes, and their communication. Knowing exactly who communicates with whom is important and can help to organize and optimize communications.
• To understand the document flow. Business processes produce and consume documents (regardless of whether these are paper or electronic documents). Understanding where the documents are going, and where they are coming from is important. A good overview of the documents also gives us the opportunity to identify whether all of the documents are really necessary.

• To identify potential bottlenecks and points of improvements, which can be used later in the process optimization phase.

• To introduce quality standards such as ISO 9001 more successfully, and to better pass certification.

• To improve the understandability of quality regulations that can be supplemented with process diagrams.

• To use business process models as work guidelines for new employees who can introduce themselves to the business processes faster and more efficiently.

• To understand business processes, which will enable us to understand and describe the company as a whole.

A good understanding of business processes is very important for developing IT support. Applications that provide end-to-end support for business processes, can be developed efficiently only if we understand the business processes in details.

**Modeling Method and Notation**

Efficient process modeling requires a modeling method that provides a structured and controlled approach to process modeling. Several modeling methods have been developed over the years. Examples include IDS Sheer’s the ARIS methodology, CSC’s Catalyst, Business Genetics, SCOR and the extensions PCOR and VCOR, POEM, and so on. The ARIS methodology has been the most popular methodology, and has been adopted by many software vendors. In the next section, we will describe the basics of the ARIS methodology, which has lately been adapted to be conformant with SOA.

**ARIS**

ARIS is both a BPM methodology, and an architectural framework for designing enterprise architectures. Enterprise architecture combines business models (process models, organizational models, and so on) with IT models (IT architecture, data model, and so on).
ARIS stands for **Architecture of Integrated Information Systems** and comprises of two things, the methodology and framework, and the software that supports both. Here, we will give a brief introduction to ARIS methodology and framework, which dates back to 1992.

The objective of ARIS is to narrow the gap between business requirements and IT. The ARIS framework is not only about process models (describing business processes), although process models are one of the most important things of ARIS. As enterprise architecture is complex, ARIS defines several views that focus on specific aspects such as business, technology, information, and so on, to reduce the complexity. The ARIS framework describes the following:

- Business processes
- Products and services related to the processes
- The structure of the organization
- Business objectives and strategies
- Information flows
- IT architecture and applications
- The data model
- Resources (people and hardware resources)
- Costs
- Skills and knowledge

These views are gathered under the concept of ARIS House, which provides a structured view on all information on business processes. ARIS House offers five views:

1. The process view (also called the control view) is the central view that shows the behavior of the processes, how the processes relate to the products and services, organization, functions, and data. The process view includes the process models in the selected notation, and other diagrams such as information flow, material flow, value chains, communication diagrams, and so on.

2. The product and service view shows the products and services, their structures, relations, and product/service trees.

3. The organizational view shows the organizational structure of the company, including departments, roles, and employees. It shows these in hierarchical organizational charts. The organization view also shows technical resources and communication networks.
4. The function view defines process tasks and describes business objectives, function hierarchies, and application software.

5. The data view shows business data and information. This view includes data models, information maps, database models, and knowledge structures.

The ARIS House is illustrated in the following figure:

```
In ARIS House, the process view is the central view of the dynamic behavior of the business processes and brings together the other four static views, the organizational view, data view, function view and product/service view.

In this book, we will focus primarily on the process view.

Each ARIS view is divided further into phases. The translation of business requirements into IT applications requires that we follow certain phases. Globally, three general phases are likely to be used:

- Requirements phase
- Design specification phase
- Implementation phase

ARIS is particularly strong in the requirements phase, while other phases may differ depending on the implementation method and the architecture we use. We will talk about these later in this chapter.

Let us now look at the other important aspect, the business process modeling notations.

**Modeling Notation**

Process modeling also requires a notation. In the past, several notations were used to model processes. Flow diagrams and block diagrams were representatives of the first-generation notations. Then, more sophisticated notations were defined, such as **EPC (Event Process Chain)** and **eEPC (Extended Event Process Chain)**. **UML activity diagrams**, **XPDL**, and **IDEF 3** were also used, in addition to some other less-known notations. A few years ago a new notation, called **Business Process Modeling Notation (BPMN)** was developed. BPMN was developed particularly for modeling business processes in accordance with SOA. In this book, we will use BPMN for modeling processes.

**BPMN**

BPMN is the most comprehensive notation for process modeling so far. It has been developed under the hood of **OMG (Object Management Group)**. We will provide a detailed introduction to BPMN in the next chapter. Here, we will only give a brief introduction to the most important BPMN elements so that you can read the diagrams presented later in this chapter.

The most important goals while designing BPMN have been:

- **To develop a notation, which will be understandable at all levels:** In business process modeling different people are involved, from business users, business analysts, and process owners, to the technical architects and developers. The management reviews business processes at periodic intervals. Therefore, the goal of BPMN has been to provide a graphical notation that is simple to understand, yet powerful enough to model business processes at the required level of detail.

- **To enable automatic transformation into executable code, that is, BPEL, and vice-versa:** The gap between the business process models and the information technology (application software) has been quite large in existing technologies. There is no clear definition on how one relates to the other. Therefore, BPMN has been designed specifically to provide such transformations.
To model the diagrams, BPMN defines four categories of elements:

- **Flow objects**, which are activities, events, and gateways. Activities can be tasks or sub processes. Events can be triggers or results. Three types of events are supported: start, intermediate, and end. Gateways control the divergence of sequential flows into concurrent flows, and their convergence back to sequential flow.

- **Connecting** objects are used to connect flow objects together. Connectors are sequence flows, message flows, and associations.

- **Swim lanes** are used to organize activities into visual categories in order to illustrate different responsibilities or functional capabilities. Pools and lanes can be used for swim lanes.

- **Artifacts** are used to add specific context to the business processes that are being modeled. Data objects are used to show how data is produced or required by the process. Groups are used to group together similar activities or other elements. Annotations are used to add text information to the diagram. We can also define custom artifacts.

The following diagrams show the various notations used in BPMN:

Activities are the basic elements of BPMN and are represented by rectangles with rounded corners. Plus A plus sign denotes that the activity can be further decomposed:

```
Name
```

Decisions are shown as diamonds. A plus sign inside the diamond denotes a logical AND, while an x denotes a logical OR:

```
\[ + \]
```

[ 67 ]
Events are shown as double circles:

![Double Circle](image)

Roles are shown as pools and swim-lanes within pools:

<table>
<thead>
<tr>
<th>Pool name</th>
<th>Swimlane</th>
<th>Swimlane</th>
</tr>
</thead>
</table>

A Document is shown as follows:

![Document](image)

The order of activities is indicated by an arrow:

![Arrow](image)

The flow of a document or information is shown with a dashed line:

![Dashed Line](image)

BPMN can be used to model parts of processes or whole processes. Processes can be modeled at different levels of fidelity. BPMN is equally suitable for internal (private) business processes, and for public (collaborative) business-to-business processes. Internal business processes focus on the point of view of a single company, and define activities that are internal to the company. Such processes might also define interactions with external partners.

Public collaborative processes show the interaction between all involved businesses and organizations. Such processes models should be modeled from the general point of view, and should show interactions between the participants.
Chapter 2

Process Design

The main activity in process design is the recording of the actual processes. The objective is to develop the as-is process model. To develop the as-is model, it is necessary to gather all knowledge about the process. This knowledge often exists only in the heads of the employees, who are involved in the process. Therefore, it is necessary to perform detailed interviews with all involved people. Often, process supervisors might think that they know exactly how the process is performed. However, after talking with those employees who really carry out the work, they see that the actual situation differs considerably. It is very important to gather all this information about the process, otherwise it will not be possible to develop a sound process model, that reflects the as-is state of the process.

The first question related to the as-is model is the business result that the process generates. Understanding the business result is crucial, as sometimes it may not be clearly articulated.

After the business result is identified, we should understand the process flow. The process flow consists of activities (or tasks) that are performed in a certain order. The process flow is modeled at various levels of abstraction. At the highest level of abstraction, the process flow shows only the most important activities (usually up to ten).

Each of the top-level activities are then decomposed into detailed flows. The process complexity, and the required level of detail, are the criteria that instruct us how deep we should decompose. To understand the process behavior completely, it makes sense to decompose until atomic activities (that is, activities that cannot be further decomposed) are reached.

When developing the as-is process model, one of the most important things to consider is the level of detail. In order to provide end-to-end support for business processes using SOA, detailed process modeling should be done. The difficulties often hide in the details!

In the process design, we should understand the detailed structure of the business process. Therefore, we should identify at least the following:

- Process activities at various levels of detail
- Roles responsible for carrying out each process activity
- Events that trigger the process execution and events that interrupt the process flow

Documents exchanged within the process. This includes input documents and output documents

Business rules that are part of the process.

We should design the usual (also called optimal) process flow and identify possible exception scenarios. Exceptions interrupt the usual process flow. Therefore, we need to specify how the exceptions will be handled.

The usual approach to the process design includes the following steps:

1. Identifying the roles
2. Identifying the activities
3. Connecting activities to roles
4. Defining the order of activities
5. Adding events
6. Adding documents

We should also understand the efficiency of the business process. This includes resource utilization, the time taken by involved employees, possible bottlenecks and inefficiencies. This is the reason why we should also identify metrics that are used to measure the efficiency of the process. While some of these metrics may be KPIs, other metrics relevant to the process should also be identified.

We should identify if the process is compliant with standards or reference processes. In some industry domains, reference processes have been defined. An example is the telecommunications industry where the TMF (Telecom Management Forum) has defined NGOSS. Part of NGOSS is eTom (Enhanced Telecom Operations Map), which specifies compliant business processes for telecom companies. Other industries have also started to develop similar reference processes.

We should also identify the business goals to which the process contributes to. Business goals are the same as the process results. A business process should not only have at least one result, but should also contribute to at least one (preferably more than one) business goal. Here, we can look into the company strategy to identify the business goals.

We should also identify the events that can interrupt the process flow. Each process can be interrupted, and we should understand how this happens. If a process is interrupted, we might need to compensate those activities of the process that have already been successfully completed. Therefore, we should also specify the compensation logic related to different interruption events.
Finally, we should also understand the current software support for the business process. This is important because existing software may hide the details of process behavior. This information can also be re-used for end-to-end process support.

Once we have identified all of these artifacts, we will have gathered a good understanding of the process. Therefore, let us now look at the results of the process modeling.

**Results of Process Modeling**

The results of the process modeling phase are:

- Process map, which shows the relationship between various business processes and the interactions between these processes.
- Roles and relations structure diagram, which shows the roles involved in business processes, and the relationships between the roles.
- An as-is process model model for each individual process. This describes in detail the existing business process, including the process flow, activities, roles, and documents (discussed later in this section). It can also contain the identified optimization points.

**Process Map**

The process map includes all business processes in the company. If the existing processes are redesigned, the process map is updated with the newly-identified processes. The process map gives an overview of all of the processes, and is very important for understanding the structure of processes in the company.

The process map also shows the relationship between business processes and their points of connection. Usually, business processes are not isolated, but interact with other processes. The connection points show where this interaction occurs.

The process map also shows the document flow. It shows which documents are consumed by each process, and which documents are generated by each process. This includes process-specific documents and general purpose documents such as standards, regulations, internal acts, and so on.
The following figure shows an example of a process map for project management:

Roles and Relations Structure
The roles and relations structure diagram shows the roles and groups, and their relations. This is not a hierarchical diagram, such as an organizational diagram. Rather, it shows the relations in the style of network diagram. It shows relationships such as participations in a group, supervisions, communications, substitutions, and so on.
The following figure shows an example of a roles and relations structure:

As-is Process Model
The as-is process model for each business process consists of the following:

- Process environment diagram, which shows the relationship of this process to other processes.
- Top level process model, which shows the high-level activities and the flow of these activities, along with the responsibilities of the roles involved in the process.
- Detailed process maps for each high-level activity, with detailed representations of process activities. The detail process map may have several decomposition levels, depending on the complexity of each high-level activity.
Exception handling diagram. When modeling a business process, it is very important that we don't end up modeling only the optimal process flow. We must not forget to identify the possible exceptions that might occur, and specify how these exceptions are handled. An exception handling diagram shows exactly this.

In the following sections, we will describe the process environment diagram, top-level process modeling, detailed process maps, exception handling diagram, and responsibilities diagram. Let's start with the top-level process model.

**Process Environment Diagram**

The process environment diagram shows the highest-level process view, where the whole process is shown as a single activity. In this way, we look at the process as a black box. In the process environment diagram, we show:

- Process trigger, which tells us how the process is triggered to start the execution
- Necessary input information required in the process
- Process result or results
- Roles involved in the process or responsible for the process
- Responsibilities of the roles within the process (such as 'responsible-for', 'executes', 'participates', 'supervises', and so on)
- Metrics used for measuring process efficiency
- Events that can interrupt the regular process flow, and the compensation logic required to handle these interruption events
- Compliance with standards, or reference processes
- The business goals a process contributes to
The following figure shows the general layout of the process environment:
In a specific process, we define the process-specific information as shown in the following figure:

The process environment diagram does not show the process flow details. This is shown in the process model, which is described in the next section.
Top-level Process Model

The top-level process model shows the highest-level view of the process activities. Usually, the top-level process model shows a limited number (for example, up to ten) of well-structured activities that represent the high-level process flow.

The top-level process model also shows the roles that participate in the process, the main decisions taken during execution of the process and the most important exceptions.

The following figure shows a general top-level process model:
An example top-level process model for procurement business process is shown in the figure that follows:

The top-level process model does not show the details of the process activities. These are shown on the detailed process maps.
Detailed Process Maps

Detailed process maps show the detailed process decomposition. (The top-level process activities included in the top-level process model are decomposed into detailed sub-processes.) The decomposition is done from the perspective of individual roles involved in the process.

For each top-level activity, a detailed process map is developed. (If a process is more complex, then these process maps are further decomposed into more detailed process maps, until the atomic activities are reached). Atomic activities are activities that do not need to be decomposed further. Atomic activities are well understood, and can be seen as distinct software operations, that will be implemented in order to provide end-to-end support for the process. Atomic activities can also be human tasks.

While modeling processes for SOA, it is very important to achieve the correct level of details. This means that the process should be decomposed to a low level of detail. This is important because the difficulties are often in the details. It is also important because, as developing SOA services we need to understand the details in order to implement them successfully.

The detailed process map also shows the conditions and the business rules. It is important to identify the business rules. In SOA, business rules are extracted and implemented within Business Rules Management Systems (BRMS). Identification of business rules should be done in their generic forms so that the business rules can be re-used in other processes. Therefore, we should strive to write down the generalized rules.

We should also identify the events that occur in the process. Events can interrupt the process flow. Events can also be generated by the process. It is important that we identify all relevant events.

When designing the detailed process flow, we put activities into swim-lanes to show the roles that are responsible for carrying-out specific activities. We also show which documents are inputs to certain activities, and which documents are generated by the activities.

The following figure shows an example of a detailed process map:

**Exception Handling Diagram**

When designing the process, it is also particularly important that we should identify not just the regular process flow, but also the exception flow that each process has.

If an exception occurs, it should be handled. The exception handling diagram should show how to handle these exceptions. We should specify how exceptions are handled and by whom, and where the process goes on after the exception has been handled.

Often, exceptions require that we compensate activities of the process flow that have already been completed successfully. We might also want to compensate activities if an event interrupts the process flow.
The exception handling diagram is shown separately (separate from the regular process flow). The following example shows an exception in a process flow:

The following exception handling diagram shows how to handle exceptions and compensate:
Publishing and Communicating Process Models

An important part of business process modeling is communicating the models to all interested parties. This includes company management, unit management, supervisors, employees, quality assurance, and all other interested employees, all of whom can use the process model to better understand what is going on within the organization. They can also use the process model as work instructions.

Publishing the process model and communicating it to all interested employees is also important, because this way, we can gather feedback on the process and improve it even further. Publishing a process on the company's intranet is usually a good way to give visibility to process models.

Feedback on the process models can improve the quality, and can be a good source of ideas for improving and optimizing the process. This is the first step in building a continuous awareness about processes and their optimization among process owners and all others involved in the process.

Process Simulation

Process simulation is a useful feature that can help us verify an existing process model, identify bottlenecks, and prepare ideas for process optimization. Simulation is a proven approach to identifying possible bottlenecks, assessing the costs of running a process, and identifying potential problems with resources and their allocation.

The results of the simulation are used to define the optimizations in the process and to model the so-called to-be process, which will help the company to work more efficiently and produce better value.

For efficient simulation, we must have enough knowledge about the process itself, such as:

- How many instances of the process are started in a certain period?
- How are these distributed over the day, week, or month?
- How long does it take, on average, to execute a particular activity?
- How much cost (other than time) is incurred by the activity?
- What quantity of which resources are utilized?
- Is there any start-up cost or waiting cost for an activity?
- How are the outcomes of decisions distributed (for example, if process behavior differs from the type of contract)?
Gathering this information can be time-consuming and can also lead to results that are not completely relevant. Sometimes, it is very difficult to assess the average execution time of a certain activity. This is particularly problematic if an activity takes a variable amount of time in the real world. If you ask an employee, he or she might not give you relevant information, because people simply don’t measure the time it takes to complete an activity and do not calculate averages. In addition, there are many practical problems, for example, interruptions in the form of emails, phone calls, or a colleague knocking on the office door during the activity execution.

Tools for Simulating Processes
To make simulation efficient, we also need good tools, that can support simulation. Most SOA platforms such as Oracle, IBM, and BEA have built-in support for process simulation, which offers good capabilities and are likely to improve further in the future versions. In the market, we can also find several other tools, some of which are specialized in process simulation.

To identify the characteristics of a good tool, the following guidelines should be taken into account:

- **Ease of developing the process model:** Ease of use allows people other than process analysts to be involved in the development of the process model and to make changes themselves.

- **Verification and correctness of the process model:** Good tools should allow automatic verification of models to assess their validity.

- **Different perspectives and support for process patterns:** A good tool should support process, resource, and data perspectives. The process perspective shows the process flow, the resource perspective shows the resource utilization, and the data perspective describes the documents used in the process.

- **Flexibility:** Tools should provide means to specify the costs of activities, start-up costs, waiting costs, resource utilization, and all other relevant aspects. It should also provide support for distribution of incoming requests, support for queues, overload, and so on.
• **Animation:** Graphical animation of simulations can be very useful and can give insights into how the process executes. Visualization can reveal bottlenecks and all other problems that might occur in the process.

• **Scenarios:** Support for different scenarios within a simulation is useful. We can change the load patterns and the behavior patterns of activities while leaving the general flow of the process as it is. This can help simulate different real-world cases.

• **Results:** A good tool should give various types of results, such as statistics. Results should be presented in an easy-to-understand format. Good tools also provide what-if analysis support and conclusion-making support.

### Modeling Principles

When modeling business processes, our objective should be to develop sound process models. Soundness of the process models can be achieved if we follow some basic principles:

• **Syntax:** Our model must have correct syntax as defined by the modeling notation. If we use BPMN, we should follow the BPMN syntax rules. Most tools can check the syntax.

• **Semantics:** Our model should also be semantically correct. This means that we have included all relevant activities, decisions, events, documents, and other elements. This also means that the process flow is correct, and we have defined how to react to events, how to handle exceptions, and how to compensate, if necessary. We should also use the correct names for all elements. Achieving semantic correctness is more difficult than achieving syntactical correctness. Usually, it helps if we follow a selected method such as ARIS.

• **Relevance:** We should model only those processes that are relevant to the problem domain. In modeling processes, we could easily get carried away because one process will typically relate to other processes. Sometimes, it is difficult to draw a line between what we should include and what we should not. The most basic principle is to include only those artifacts that are relevant from the perspective of the process and the problem domain we are focusing on. Too much modeling is a waste of time.
• **Cost versus benefit**: We model processes to achieve specific benefits. We should therefore weigh the amount of effort against the anticipated benefits. Usually, the 80/20 rule applies here as well. 80% of the benefit comes from 20% of the effort, and vice versa. Therefore, it is important to know the level of detail and when it is better to stop modeling. The required level of detail can differ. If we are performing process modeling for quality assurance, a lower level of detail is required than if we are performing process modeling for an SOA implementation.

• **Usability**: The model should be usable and understandable. Otherwise, the model is worth nothing. Business processes are complex. To achieve usability, we should decompose the model into various levels of detail. How we do the decomposition is important, as the parts should be understandable. We usually prefer simple models over more complex ones.

• **Standards**: While modeling business processes, we should use and apply certain standards. First, we should use good practices and patterns. Second, we should use naming conventions. In some industries, standard or reference process models exist (such as eTom for Telecom operators). We should look for compliance, if it can add business value.

• **Integration**: We should integrate different models that look at the same or similar process domains from different perspectives. The integrated model will reveal all aspects of the process. We should also design a process map, where all processes and relationships between them are listed.

Using these and some other more specific principles will help make our process models better, and more usable over a longer period of time. We should, however, be aware that modeling processes is not easy, although it might look easy at first sight. Therefore, in the next section, we shall list common problems that we are likely to face.
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