

REPRESENTATION OF BUSINESS INFORMATION FLOW WITH AN EXTENSION FOR UML

From Business Processes to object-orientated Software Engineering

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Abstract: The use of enterprise software solutions is getting increasingly important. Today thousands of users are able to work in an integrated enterprise solution. The requirements of software systems have changed dramatically in quality and quantity in the last decades. While the know-how in technology was the main factor for success in the past, today much more effort is needed and involved to understand what the customer wants. At this point *Business Process Engineering* became an important way to describe the business and system requirements. It focuses on requirements, terminology, processes, dependencies, and on the *Business Information Flow*, which is the subject of this article. There are several procedures and methodologies available for modeling business process requirements. Most of them are focused on a particular area of business and utilize a special modeling technique often used to customize a standard software solution. A better way, specifically for non-standard software solutions is the use of an independent modeling language like the UML. The UML is well established in the domain of object orientated software development (Meta, 2003). For business process modeling more investigations are required, especially on how to represent business information flow. An appropriate way, as we propose here, is to add business information flow to UML *Use Case Diagrams*.

1 INTRODUCTION

The software development process ranging from the business processes to a usable enterprise solution is an interesting and important field with increasing attention from researchers and industries. There are still open questions, especially how to represent business process requirements. An important aspect is the *Business Information Flow* (BIF), which is investigated here.

This article is about the representation of BIF, which is part of the overall Business Process Flow. We add BIF to use case diagrams to improve the validation process and to provide essential information for business analysts, customers and software developers. The combination of use case diagrams and information flow is easy to read and simple to understand.

Various modeling languages are available to describe business process requirements. Some of them are used to customize a pre-configured software solution and can only be used by

experienced designers. Usually the process description is not reusable and the effort invested during the analysis phase is lost.

The *Unified Modeling Language* (UML) is a reasonable alternative. UML is a well-known modeling language and used in many software development projects. UML is independent of any software solution and requires no special tools.

Unfortunately UML is not expressive enough for *Business Process Engineering* (BPE), in particular to represent the information flow (Ambler, 2000). Therefore an extension for UML Use Case Diagrams will be presented, which makes it simpler to efficiently represent the flow of information.

The proposed extensions belong to a *Business Profile*, called 4BP. The 4BP profile provides several representation symbols for business process modeling. For the representation of BIF we will introduce some symbols out of 4BP. The extensions will help us to understand which parameters affect a single use case.

A further benefit of the extension is evident in the validation process. For a software developer it is

important to find as much as possible of information in one place; so for the customer, who is interested if his business requirements are described properly. The combination of the UML use cases diagrams with the extension is an appropriate way, understandable, for business analysts, software developers, as well for the customers. All information can be depicted in one diagram, use cases, actors, input & output data, global values, as well as triggers.

In the following sections you will find a brief overview about *Business Process Engineering*, followed by the *Business Information Flow*, the *UML Use Case Diagrams* and the *Representation of Business Information Flow*. A small example at the end shows how to apply the extension.

2 ABOUT BUSINESS PROCESS ENGINEERING

Business process engineering is an important discipline as a result of the growth of informational enterprise system. When developing an entire enterprise solution, BPE is the very first step to capture and structure the business requirements in an adequate way.

BPE describes the way what an enterprise does. It describes the business from the customer's perspective. The business processes consist of two different parts, a static system structure and a dynamic system behavior.

The static system structure consists of business sections divided into business components. The business components contain business objects.

The dynamic system behavior consists of data, information, global values, triggers and flows of input & output data. This is the BIF, which is added successively to the static structure during the requirement analysis phase.

Figure 1 gives an idea of business process engineering. To reduce the complexity only some levels are shown. Beginning with the enterprise, several phases of analysis, modeling and abstraction are needed until all requirements are represented with UML.

The BIF (see second layer from top) contains data used by the business processes during process execution. The data is exchanged by the processes or flows into central databases.

Many business requirements can already be represented with UML, but a question remains: How to represent BIF with UML?

For enterprise solutions, such as ERP systems, the engineering process from the business processes

to the final software solution is fully supported. The representation of the information flow is already part of the solution (e.g. as integrated databases and data flow management systems). The disadvantage is the use of proprietary representation techniques. Most techniques are not compatible to each other and make it difficult to reuse a business process description for a different purpose, e.g., for quality management (ISO 9002). Valuable work done by business analysts, users and developers during the

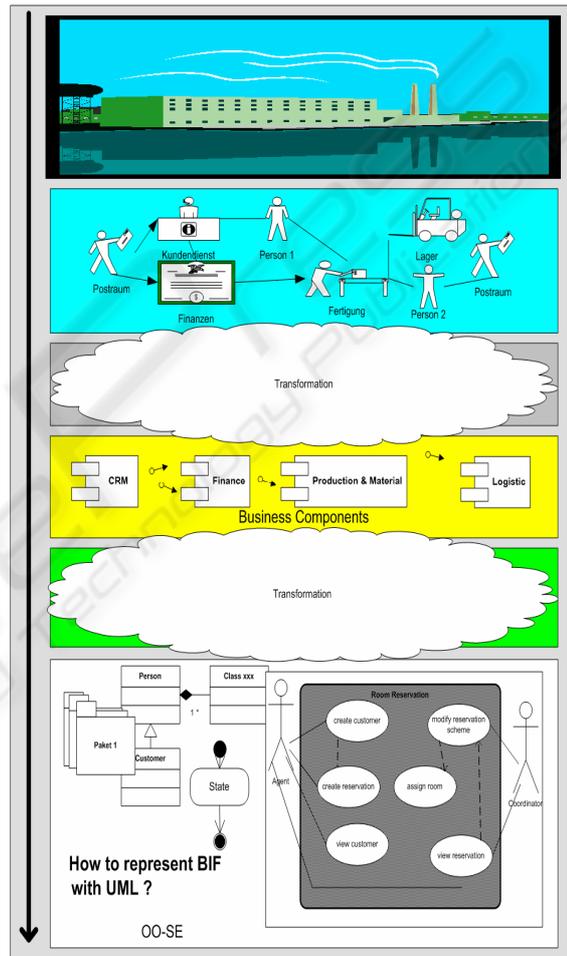


Figure 1: From Business Processes Engineering to object-orientated Software Engineering

requirement analysis phase is lost.

Especially for non-standard solutions, UML is an alternative. It is widely accepted and provides already different kind of shapes for the representation of the static structure view and the dynamic behavior; shapes like components, packets, actors, use cases, classes, associations and generalization etc.

Additional shapes and symbols are required for BPE (Scheer, 2003; Ambler, 2000) to support the representation of business requirements.

3 BUSINESS INFORMATION FLOW

Inside business information flow data is transferred, such as documents, lists, reports, a work order, protocols, company templates or data like the address of a customer or a supplier.

For business processes (activities) the availability of information is a precondition for task performance. For instance, for a room reservation we need several data about a customer. Therefore it is important to investigate the input data and output data during the requirement analysis phase. While a business activity performs, the BIF (data) maybe changed, modified or deleted. Maybe some more data is generated.

Business information flow consists of *Global Data*, which is generally not changed during the business process activity; *Process Data*, which is used or changed during the business activities and is known as input & output data; and *Triggers*, which are used to control business processes, e.g. to enable or disable a business use case.

The task of business information flow is to transport data between the business processes. A special representation for BIF is required.

4 USE CASE DIAGRAM

A UML use case diagram covers information about actors, use cases, extend and include relations and inheritance (see figure 2), but does not show the influencing business parameters, like input and output data or globally used data (Scheer, 2003).

Because of the missing focus on business processes, especially the missing focus on BIF, use case diagrams are not very useful for BPE. The effort to work with the diagrams is too high compared to the result in addition. Too few information are available about the influencing parameter.

Adding BIF to UML use case diagrams, as shown next section will enrich the diagrams with valuable information. It improves the validation process and provides essential information for business analysts, software developers, as well for the customers. It is likely that use case diagram will be used much more in future.

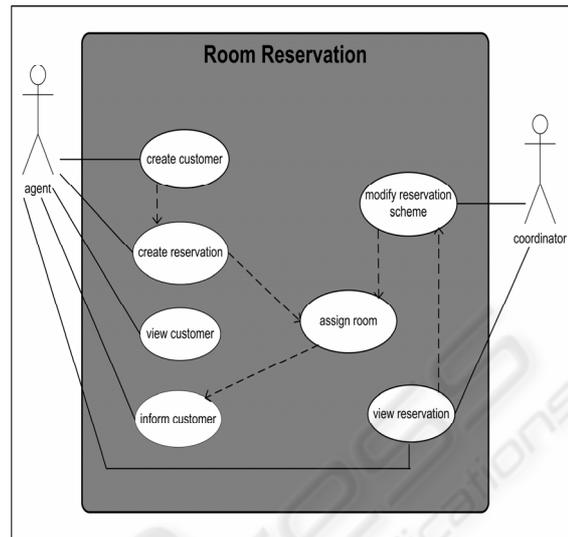


Figure 2: Use Case Diagram

5 REPRESENTATION OF BUSINESS INFORMATION FLOW

The symbols, presented here are also used in a similar way by IDEF (*Integration Definition For Function Modeling*), a family of methods for enterprise modeling and analysis.

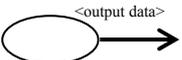
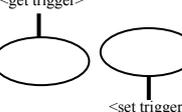
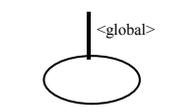
For the representation of business information flow we introduce symbols for *input & output data* (process Data, like documents, list, reports), as well as a symbol for *triggers* (process control), which are used to control business use cases and we introduce a symbol for *global data* (global data is not modified in general).

Table 1 summarizes the new symbols for BIF. An arrow is used for input & output data, indicating the direction of data flow. Close to the arrow the type and name of the data is specified. If the number of data exceeds the available space in the diagram, a reference should be used instead of the full names. The point the arrows are connected to the use case symbol is optional.

For a trigger we use a single line. The name of a trigger is placed on top of the symbol. Because triggers have a special function within the flow of business information, it is recommended to place triggers on top of or below of the use case symbol.

The global data symbol is also recommended to put on top of the use case symbol and is represented as a line as well. The designator of global data is placed beside the symbol.

Table 1: Types of Business Information Flow

type	description	symbol
<Input>	Represents input data, such as lists, documents and information.	
<Output>	Represents output data, such as lists, documents and information.	
<Trigger>	Represents a Trigger. Enables or disables a business use case.	
<Global>	Represents global data. Global values are not changed in general.	

To save symbols and maintain clarity, a “trigger” and a “global” can be combined and depicted in one symbol.

Figure 3 shows an example “Room Reservation”, a use case diagram added with business information flow.

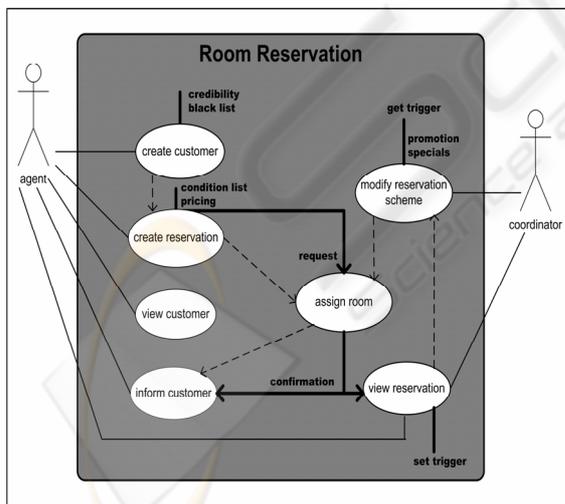


Figure 3: Use Cases Diagram with Business Information Flow

An agent for instance “creates a reservation” (use case). To make a reservation “the condition list” and “pricing tables” are needed. This kind of business information flow is global data and is represented

with an undirected small line on top of the use case. If all data is available, such as customer name, address, timeframe of stay and category then a “request” is send to “assign room” (use case) and the reservation can be completed. An assignment is made according to the booked category and a “confirmation” (output data) is generated. The “confirmation” is also input data for the use cases “view reservation” and “inform customer”. The input and output data, such as “request” and “confirmation” are represented with an arrow.

For a trigger, for instance, the use case “modify reservation scheme” can only be used if a trigger is set to enable the use case. Triggers are important for business process controlling.

6 CONCLUSION

We propose an extension of UML to combine dataflow information with use case diagrams. It is an easy simple extension with arrows for “input & output data” and single lines for “triggers” and “global data”. It provides essential information for software developers, as well as for the customer and improves the validation process. The extension in combination with UML is easy to use in any software development project and is not dependent on special software. The business process modeling is reusable, for instance for quality managements purposes.

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