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Data Standardization in Changing Enterprises

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ABSTRACT

During the last decades, the frequency of business changes and the time in which these changes have to be incorporated have increased and are still increasing. In this context, the standardization of major application data and of the communication data between applications becomes an important IT issue. However, since people from the business do not speak in a common language, it is more than a pure IT topic. Following the paradigm of today's software development, problems arise when building IT solutions based on business processes. Different people from the business using the same process may have a different understanding of the information entities with which they deal. People who are responsible for the IT solutions try to put all these issues into one product, often failing because of a lack of understanding and transparency. Additionally, important architecture concepts like service-oriented architecture are not able to gain success without data standardization. The Siemens Plc. has developed a concept for data standardization that considers the business changes. The basic idea is to take business-level specifications and use business process documentation as a starting point to ensure that a common business language is available before the application development starts. Since the Siemens Plc. is a process-driven enterprise, every business and IT change depends on business processes. Thus, to tie the data standardization to the same mechanisms seems promising.

Keywords

Business Process Modeling, Data Standardization, Business Object Types, Holistic Modeling

INTRODUCTION

Through outside-driven changes like globalization, rationalization and shifting customer needs, enterprises are pushed to change themselves. This change increased within enterprises continuously over the last years in its rate. IT changes reflect the business modification, for the reason that almost every business process revision results in a change in the supporting IT solutions with tremendous impacts on the costs of these solutions. For the most, these costs are integration costs.

In today's application world approximately 35 percent of the total cost of application design, development and maintenance are integration costs.1 And stating integration costs doesn't mean the costs for technical integration. In most cases these are costs for standardizing the information and data used as basis for the integration. The need for solving this semantic topic is therefore the reason that there is no holistic view of the companies' information architecture. This view would start with the information needs of business people based on business processes and ends with the applications, supporting these information needs.

Based on the example of the Siemens Plc, a holistic modeling methodology is described in this paper that focuses on reducing the integration cost. It is incorporated in the existing modeling methodologies used within most enterprises and focuses on the information and data level. The impacts of the approach to other topics, like Service-oriented Architecture, will be mentioned in the conclusion.

CURRENT MODELING

The development process for IT products typically and ideally adheres to the phases outlined below.[2]

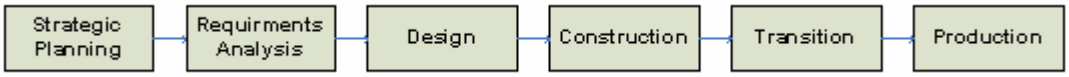

Figure 1. Phases of the IT product life cycle

The **Strategic Planning** phase involves developing a vision for the product environment, establishing priorities and defining basic conditions. The individual product is assigned a place in the overall product spectrum and subordinated to the top-level goal (corporate goal). Boundaries to other products are defined. During the **Requirements Analysis**, the project requirements are defined and documented, especially from the point of view of business and support. Based on the principles of the Zachmann framework, the starting point is the Business View and an essentially technology-driven view of the architecture is developed. During the **Design Phase** the technologies for implementation of the requirements and the architectures for that implementation are defined. During the **Construction Phase** these architectures are then implemented in technology. Product maintenance and the assurance of its conformity to formulated requirements are the focus of the **Production Phase**.

One of the challenges presented by this process is the transition between the view of the business and the view of the IT (called Implementations View in this paper), incorporated in the phases Strategic Planning und Requirements Analysis.

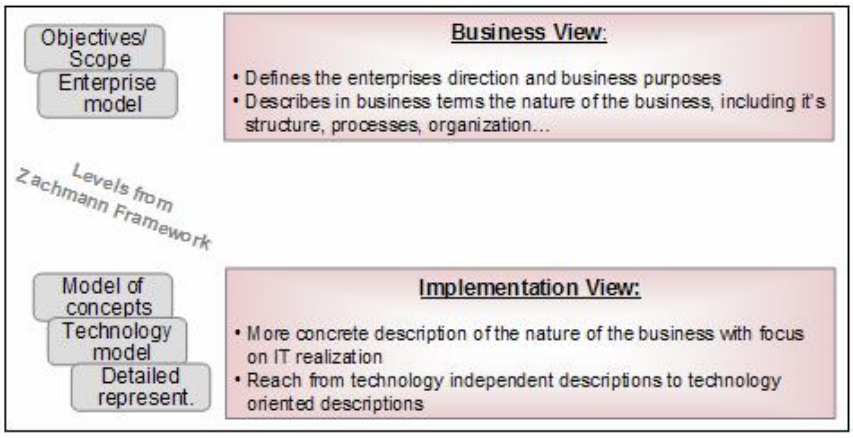

Figure 2. Views on the enterprise

Typically in the Business View there is a lack of descriptions of the information needs, from which the IT view suffers. It's often surprising, how much the understanding about the entities the business processes deal with differs between different people, working as part of the business process. This is especially true for larger enterprises and reflects historic changes in business models not documented and standardized in the business processes and as a consequence not enforced.

The following two sections describe the current status of modeling in the business and Implementation View in most enterprises. As a concrete example, the Siemens Plc is used. First the views are described briefly and how they are modeled within the Siemens PPC. Subsequently weaknesses of the current modeling regarding data modeling are outlined.

BUSINESS VIEW

The Business View is the description of the business itself, the logical flow and the Entities the Business uses to fulfill its goals. It's a broad overview of the whole enterprise, which is necessary to come to a common understanding. From the data modeling standpoint semantic models are created.

Process models are the most common way used for describing the Business View. Different methodologies are in use, including one of the most popular ones, Event-driven Process Chains (EPCs).

In the Siemens Plc different process levels defined, which are shown in the following picture. On Level 0 process groups are identified, Level 1 and 2 are described using value-added chains. Event-driven process chains (EPC) are used for level 3 and below. All process descriptions are stored in a central repository and are accessible via a global Web export.

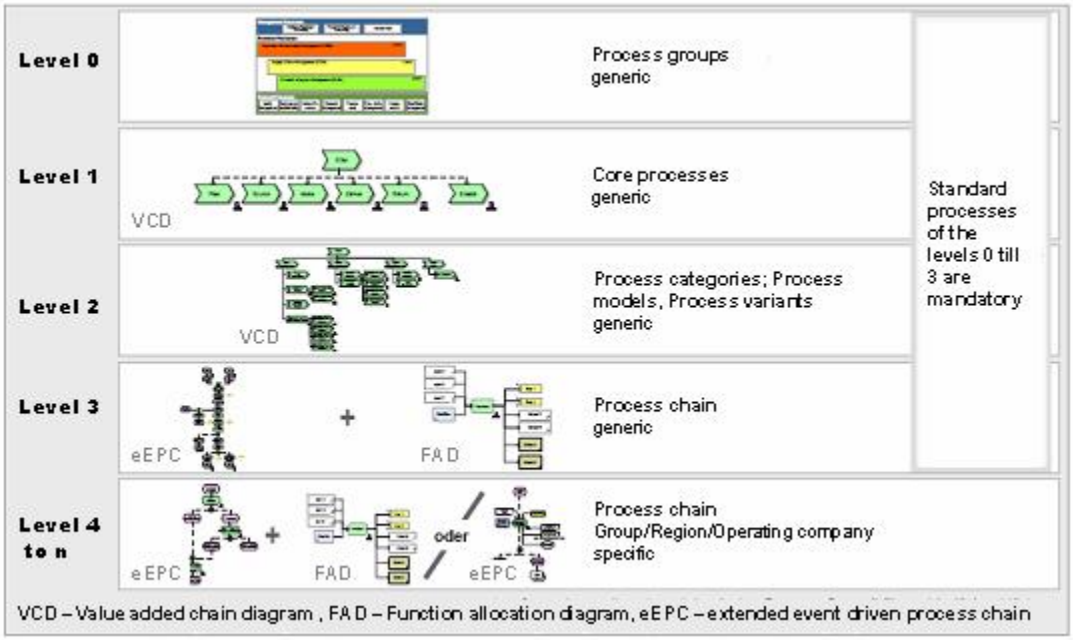

Figure 3. Level concept for process modeling (Siemens Plc)

The models of levels 3 to n are especially relevant as the basis for a technical description of IT products, as these levels offer a detailed description of process elements and events in the form of a logical "flow chart".

The Business View is per definition on some kind of high level. In cases where a deeper level is available it is often outdated. However, the Business View is the only and for this reason the most important starting point for any change. During this change, the business models will be updated and redefined to reflect the change. The right level of detail is then the key for a successful transformation and usage for the changing IT support. The semantic data models to create a common understanding, which belong in this view, are seldom available. From the data modeling prospective they are very important, for the reason, that they reflect the common language the business speaks, the basis for the Implementation View and any communication between applications and application internal data models

IMPLEMENTATIONS VIEW

The Implementation View is the description about the IT implementation and support of the Business View. From the data modeling prospective logical and physical data models are created.

This view is modeled according to different methodologies in several different places within enterprises. Modeling based on Unified Modeling Language is becoming increasingly popular for levels of detail close to implementation.

UML contains a series of diagram types that fulfill different tasks within the framework of the IT architecture description.

In the Siemens Plc data modeling based on UML has started, however it is still more common to have modeling with Entity Relationship Models.

The quality of modeling within IT projects is generally high, but differs very much between the participants. However, a broader overview of multiple projects is the exception. In general, even the link to the Business View is missing or no longer traceable within the modeling of the Implementation View. There are different reasons for this situation: People are trained to think in silos and this situation is not special to organizational units, solving the current problem is the priority, rather than understanding the big picture, which would mean that the IT people would understand the Business View, the IT solution should support.

On the other hand, the description available in the business processes is often not sufficient and the requirements the business people provide indicate at times, that they don't understand their need either or are unable to formulate it.

For data modeling where this paper focuses, the same is valid. The data models are project specific and mostly up to the project responsible, therefore the quality differs a lot. In most cases there is no general review of the logical data models to align them to each other, which also means, that no reuse of data models take place.

HOLISTIC MODELING

To create a holistic view (greek holon – the whole) is important, because this view of all information needs and the derived data descriptions would define a common language not only for business and IT people, but also for IT solutions internally and for any communication between them. Any new element as part of the holistic view has to subordinate themselves to the bigger picture in order to assure the existing communication.

The core of a holistic modeling approach is the linkage between the different views. Only one side of this is the technical linkage of elements between the different modeling approaches. The other side is the integration of the models of one view into the work done in the other views. With this kind of integration the different participants get a broader view, and they are no longer working in their "silos". However, the prerequisite to do this is the technical integration with the modeling elements. The following description focuses on the data level in the different views and how the holistic modeling is working within the Siemens Plc.

The basic idea is to use core model elements for the different views and link them to each other. For the data modeling, these core elements are the basic entities with which the business deals. The standard linkage element in the different views and the whole concept is named "Business Object Types" (BOT) within Siemens Plc. BOTs represent the basic elements the business deals with such as a person, a place, a thing or a concept.

> "***Business Object Types*** are representations of items of the real business world, which are described through properties and status (represented through attributes). Every Business Object is an instance of exactly one Business Object Type."[3]

An example for a Business Object Type is the customer with the properties:

„Name "

"Order Volume"

"DeliveryAddress"

and statuses:

"Credit Rating"

"OverallCustomerRating"

An instance or Business Object for this Business Object Type would be the customer "BMF":

„Name=BMF"

"Order Volume=$ 5 Mio."

"DeliveryAddress=2220 King Rd., New York"

"CreditRating=B+"

"OverallCustomerRating"

BUSINESS VIEW

The business view seldom describes the basic entities the business deals with. The focus in general is the process flow and the elements used to realize the flow, e.g. by activities and actors. To add the data modeling aspect, a new modeling element needs to be introduced to the business view reflects later the data entities on the implementation level.

As stated before, the business process modeling that describes the business view within the Siemens Plc is documented using different levels of abstraction. From level 3 on event-driven process chains (EPC) are used as modeling method. On level 3, the new modeling element is added to capture the information needs describing the basic elements with which the process deals, called Business Object Types. The EPC shows the general process flow. For any process step, the detailed Function Allocation Diagrams (FADs) explain in more detail. These FADs include the new introduced Business Object Types to capture the information needs of this process step. The following figure 1illustrates this.

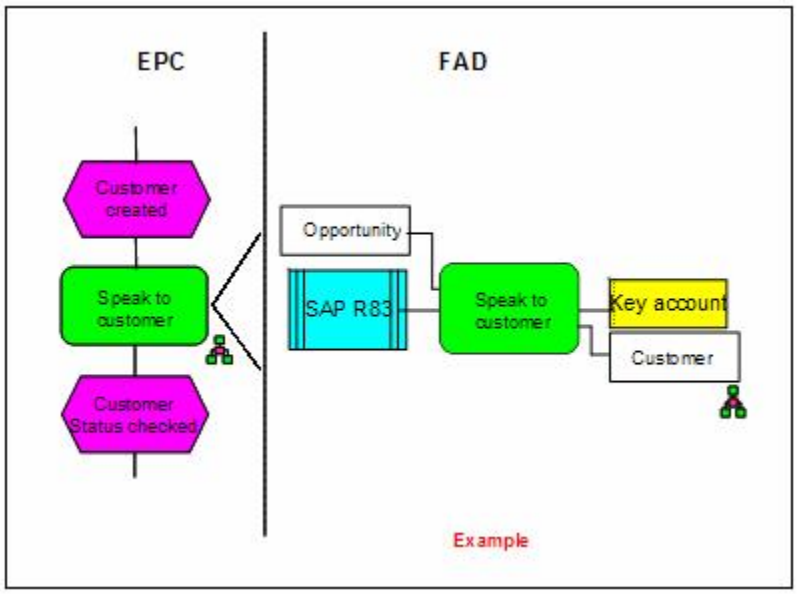

Figure 4. Modeling in the business view

The FAD shows two Business Object Types: Opportunity and Customer.

Any Business Object Type has to be described using a unique name, a description and synonyms if needed. Synonyms are very important to cover the language used by different departments, but not adding additional entities to the description. However, tracking this information and explaining that all these terms belong to the same information need and store them only once is very important. For the two BOTs shown in the example above are these descriptions available. As example the Business Object Type "Opportunity" is shown below:

Name	Synonyms	Description
"Opportunity"	-	A business opportunity describes a precise requirement of a potential customer for products or services. Precise means: Type and volume of the required services are defined roughly, the customer signaled a requirement or an interest, the supplier of the services is defined (if there are some suppliers the opportunity has to be spited), the value of the opportunity is defined roughly. Description of status: 1. DI (degree of implementation) 1: potential and responsible are identified.

Figure 5. Description of "Opportunity"

Another more detailed description is possible using Technical Term Models (TTM) to create semantic models of the information needs (BOTs). The following figure 5 shows the Technical Term model of the example "Opportunity" from Figure 4.

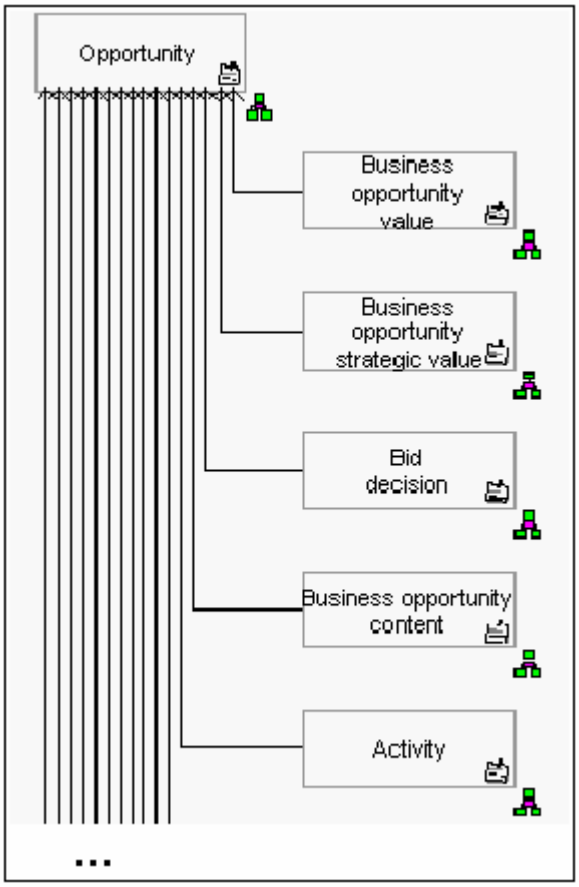

Figure 6. Technical Term model of "Opportunity"

It shows the semantic relation between the different Business Object Types used in the Business View. This kind of Technical Term Models is the basis for the logical data models of the following more IT related views.

PROBLEM DOMAIN VIEW

A direct link between the semantic Business Object Types of the business view and the project specific descriptions of an implementation level is not possible due to the different requirements and level of granularity. More important a full detailed logical data model for the whole enterprise, which has an acceptable level of accuracy and actuality, is impossible to maintain. The approaches of Enterprise-wide date modeling of the early 80's have shown this.[4]

For this reason, a different view is needed, which is using the semantic models of the business view and creates logical models for parts of the enterprise regarding a specific problem. This view is called "Problem domain View". The models created in this view are logical data models, which are strongly based on the Business Object Types and the associated available semantic models of the business view.

To maintain the linkage of these models is very important within the Problem domain View. The linkage can be done using the same object types, which would mean following the same methodology or reference the object types. Not all BOT's of the business view will have a corresponded BOT in the Problem domain View, some may be split up into two or more. For this reason a reference is the approach used within the Siemens Plc for the linkage. Along with that, the Siemens Plc has decided to use UML class diagrams for the problem domain modeling to make them more understandable for IT people. Due to the use of UML, the models can easily be extended and detailed.

IMPLEMENTATION VIEW

The Implementation View describes the concrete project level, where IT support for the business processes is developed or packaged software is selected and often customized.

Any project of the Implementation View has to follow the logical data model of the associated problem domain. This is especially valid for self-developed applications. For packaged software the customizing is based on the Business Object Types and the related logical data models.

In general, the data exchange between the applications is using the Business Object Types as the application independent interchange language. Any application that is going to communicate of the Enterprise Service Bus (ESB) has to use the defined Business Object Types for its communication.

The following figure 7 show the modeling approach in context of the different views in an overview.

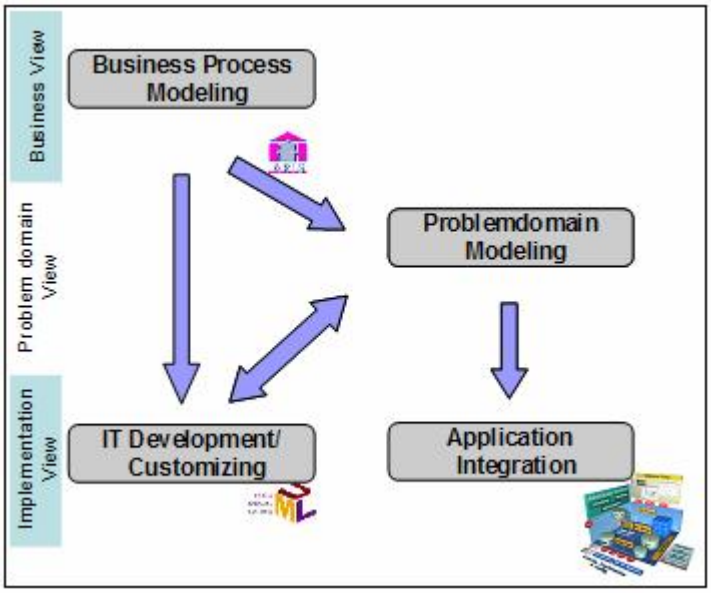

Figure 7. Holistic modeling approach

The binding element between the different views is a central repository, which maintains the Business Object Types. Additionally the relationship between the Business Object Types, used in the Business View and the Business Object Types used in the Problem domain and Implementation View are stored here.

4 STATUS OF EMPLOYMENT

The first discussion about a holistic modeling approach started within Siemens Plc in 2001, driven by three business units of Siemens. After developing a detailed modeling methodology for the business view in 2003, the process modeling with Business Object Types started in 2004. The level 3 of the business view is available with Business Object Types today. The modeling methodology using Business Object Types is mandatory for any business process modeling today.

Through this work the business processes on this level show the entities with which the business currently deals. This has brought tremendous clarification into business processes and has even lead to redefinitions of processes. Pilot projects have shown the value of this approach for the business and for IT. The service business for instance has defined data models based on the Business Object Types of the Business View and uses them as a standard for application in this field. More implementation projects have started to use the information available as part of the Business Process Models to derive application data models now.

A Problem domain modeling has started with pilot projects, but is not in a general use yet. However, the data modeling based on the business view has increased tremendously. Discussions regarding semantic issues are starting in the business view as part of the business process modeling today, involving the business experts who are responsible to clarify and describe the information needs on this level.

The central repository is planned for implementation in the next fiscal year.

SUMMARY AND OUTLOOK

The holistic modeling approach explained in this paper has major benefit for managing the data and information prospective in creating a transparent picture starting with the business needs down to the implementation of these needs. Clarification about semantic topics is done on the business level, with people from the business working with the business process. They are defining the entities they deal with, which is not common in today's modeling. This is a major benefit for the implementation or customizing of IT solutions, where a lot of costs rise because this clarification is not available. And yet IT solutions are implemented without this knowledge, which means they are partly not using the same business entities the business people usually deal with, and their integration is difficult and expensive. On the other hand it is cost intensive to get this clarification afterwards and sometimes impossible.

The holistic modeling approach and a more standardized data landscape is one of the big challenges for today and a precondition for the future. One of the current top five trends within IT is Service-oriented Architecture.[5] Standardized data (BOT) are the basis for the communication between the services of a Service-oriented architecture. Technical services might be interoperable, but on a data level they have to be interoperable as well. A service which is providing customer data has to make sure applications or other services are able to "understand" this data.

This kind of standardization is possible with a holistic modeling approach. Without standardized data (BOTs) that are derived from business-level descriptions, service-oriented architectures on an enterprise-level will fail.

To tie the IT data view and the business information needs with the help of business processes promises long-term success in managing changes. This is a major point where the historic approaches of Enterprise-wide date modeling failed.[6] To incorporate the use of the models[7] into the daily work of the people on the business-side and the IT-side is the final challenge to create a stable, model-based, and therefore transparent, enterprise. Only enterprises that archive this kind of transparency are able to manage changes effectively.

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