eLearning NG: Process improvement by identification of learning potential

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Introduction

Business processes are subject to shorter evolution cycles to fulfill changing market demands. On an enterprise-level perspective this results in altered claims to business partners, on a more detailed level requirements to resources will change as well. As far as human resources are affected, these requirements can be integrated in business process models by competence and qualification descriptions. Matching these descriptions with those already existing in human resources departments is reasonable. The presentation will introduce an innovative approach for efficient management of human capital. Areas for improvement can be revealed by new modeling methods that allow the calculation of competences required for business process execution. Means for further education necessary to meet the requirements may also be identified by an enhanced modeling technique. Modeling as well as analysis can be supported by the Horus Business Modeler (HBM). Central model repositories and a collaborative modeling platform are fundamental to help stakeholders to integrate any relevant information.

Modeling Resource Profiles and Business Processes

Modeling of resource profiles is related to two disciplines: business process management and human resource management. Common research approaches often foster the distinction of business process and competence-based resource management. As a result both disciplines have utilized different modeling techniques with a minimal overlap. While this strict differentiation is common in modeling and management techniques, several research studies [8,10,13] state that both disciplines are affected by each other. The additional strengths of an enhanced alignment of business process modeling and resource management (mainly driven by human resource departments) have been outlined in [10]. The identification of appropriate resource requirements, such as needed competences, can be driven by an analysis of business processes managed by organizations. In this context the increased interdependence and continuous changes in business processes have to be considered.

Modeling Requirements

Resource-based analysis is subject of examination in collaborative networks [11]. Since resource requirements can only be identified in business processes if tasks contain quantitative and qualitative requirements; these requirements enclose properties of resources which may be assigned to tasks [8,9]. Yet the vast majority of business process driven resource classification schemes is based upon two dimensions only: role models and organizational hierarchies. Since the formulation and derivation of resource requirements tend to be tremendously complex, these two dimensions are insufficient to cover requirements of modern resource management (especially regarding scheduling mechanisms).

Thus multidimensional, formal and machine readable approaches to business process modeling and resource description are required.

Resource description is addressed by (human) resource management and handled by different standards that describe possible attributes of resources. Most of these standards do not cover important properties necessary to describe resource requirements in business processes or are not well formalized. An approach that covers the description of human resource competences is the European e-Competence Framework (e-CF), which is a result of an initiative at European level that succeeds several earlier approaches [1,2,3,4,12]. The framework currently describes 36 categories of competences for jobs in the information and communications technology sector. Nevertheless precise and formal definitions are not included. Other approaches to describe data related to human resource planning and competences such as HR-XML [6] and RCD [7] are XML-based languages. Their data definitions are given by a set of XML schemas, thus these languages have an improved structural architecture. However these descriptions are restricted to certain aspects. Organizational characteristics and different types of resources are not reflected. Also the subject of competence descriptions lacks the distinction between the concepts skill, knowledge and competence. In order to overcome these drawbacks of current approaches such as RML (Resource Modeling Language) offer a fine grained resource description [8]. RML is a precise and extensible language conforming to existing standards of competence descriptions.

Sound modeling of Resource Profiles
The resource modeling language (RML) is a modeling approach that fulfills the described design requirements [8]. RML is based on a MOF-compliant meta-model called resource meta-model (RMM), including specialized sections such as a human resource meta-model (HRMM) and a competence meta-model (COMM). Existing standards such as RCD and HR-XML [7,6] have influenced the conceptual model of RMM, thus a transformation of existing descriptions can be transformed to RML. A detailed description of RML is beyond the scope of this paper, please see [8] instead.

RML allows describing resources and reusable competence descriptions. However RML enables modeling of details (related to business process modeling) that are not covered by other standards. Also the distinction of competences, skills and knowledge, as well as description of relationships and dependencies between these concepts is part of the language. RML enables linking of competence related information not only to personnel resources but also to role descriptions. Furthermore RML allows modeling of various organizational aspects (such as projects, groups, hierarchies or privileges). Fig. 1 shows an example of a competence description represented in RML. The illustrated competence is called Solution Deployment 2 (compare to competence B.4 in [4]).
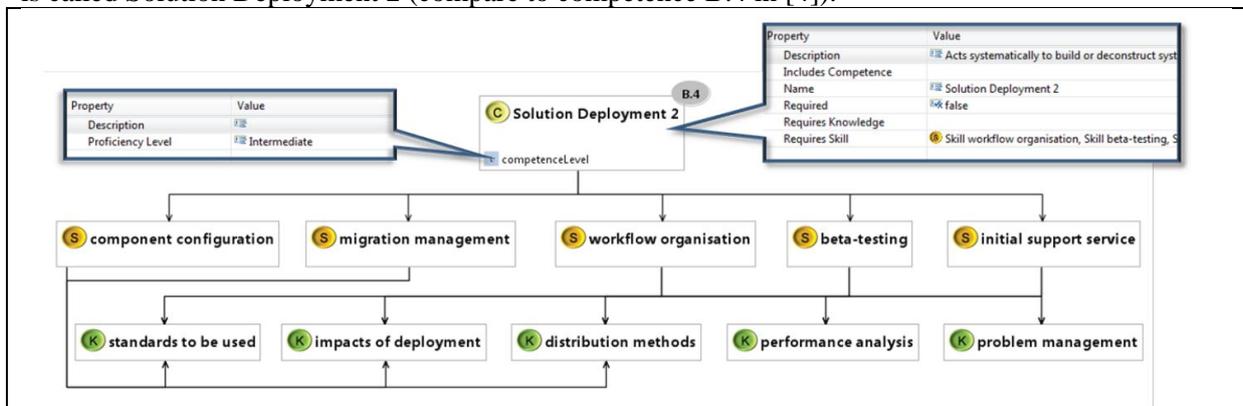

Fig. 1. - RML Instance Solution deployment

Many details of RML model elements cannot be part of the graphical model, they are modeled as properties instead (see annotations left and right of the competence element shown in Figure 1). The RML editor stores this information in an XML-Format (XMI compliant). An organizational description exemplified as RML model is depicted in Figure 2. In following example, properties of human resources (here Joe Smith) are outlined. Within the illustrated example model Joe Smith is working for an organizational unit (IT-Department) in an organizational group (SOATeam). He possesses one role (EntrepriseDeveloper) and works currently in a project (AgileCoupling). For simplicity not all details of the illustrated model elements are covered, instead properties of Joe Smith are shown in the box left to the element in Figure 2. According to RML human resources can possess set of competences, skills and knowledge besides those determined by the roles. Thus, besides requirements of assigned organizational role (EnterpriseDeveloper) Joe Smith possesses in addition competence "Solution Deployment 2" (which we outlined in Figure 1).
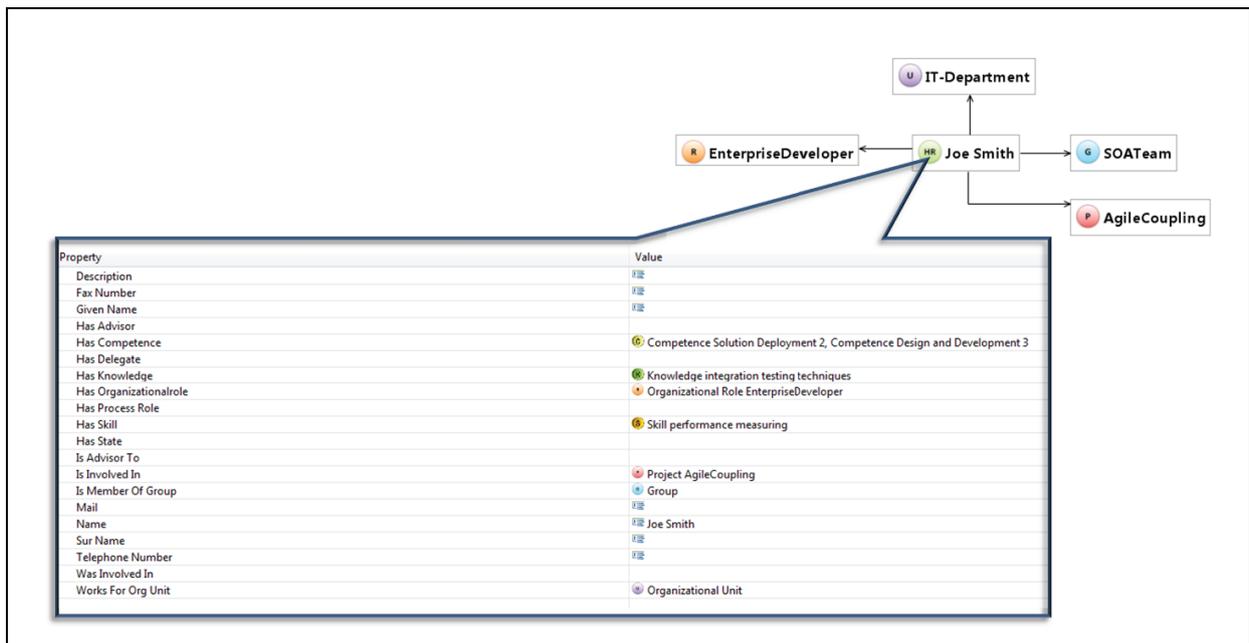

Fig. 2. Linking competence description to organizational resources

Learning Objects

As mentioned before changed business process models also imply changes in skills and competences necessary to perform tasks. The usage of RML enables the identification of gaps between requirements on the one hand and available resources and their properties on the other hand. If necessary competences, skills and knowledge cannot be covered with existing staff the need for further education or recruitment arises. Due to increased availability and a reduction of costs for computer hardware as well as internet technologies, an increased usage of multimedia learning content in teaching and further education can be monitored [14]. These electronic learning resources are the foundation of Computer Based- and Web Based Trainings (also known as CBTs and WBTs). However, authoring of electronic learning content and scenarios is time consuming and more expensive than traditional non-digital learning content. One reason is the spread of large and complex learning scenarios that can only be used within a single context. Learning Objects however address the paradigm of reusable learning content. Learning Objects are small, self-contained entities of learning, training or assessment content that can be used in multiple contexts [15, 16]. Ideally learning, training and assessment content is focused on a single learning objective.

A sample Learning Object is given in Fig. 1. The depicted Learning Object refers to the management of multiple versions of components within a Campus Management System [17]. The screen displayed in Fig. 1 contains interactive elements for training and assessment purposes. The depicted Learning Object displays the first of three assessment screens. Additionally, the Learning Object contains learning units that provide information that is necessary to gain new competences, skills and knowledge. A sample of this learning content is given in Fig. 2. All shown assessment screens can be accomplished within 15 minutes. As illustrated in Fig. 3, Learning Objects provide instant feedback after attending training or assessment elements. Moreover, within training sessions the sample solution can be displayed.

Fig. 1 - Learning Object within Sitewaerts LCMS [17]

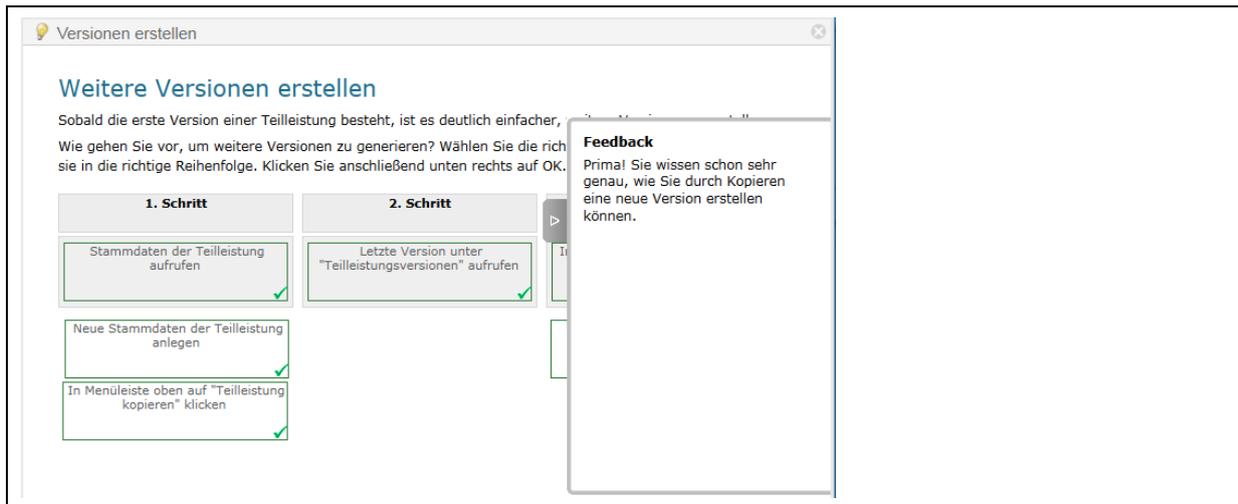**Fig. 2 - Learning Content regarding Component Version Management**

Fig. 3 - Learning Object providing Feedback for Assessment and Training Screens

Learning Objects in Business Process Models

Learning Objects contribute to achievement of new competences, skills and knowledge; however, the need to select the appropriate Learning Object within a Learning Object repository remains as an open issue. This can be addressed by extending the Learning Object's metadata. Competences, skills and knowledge that are provided by the Learning Objects need to be described within the metadata. By utilizing additional metadata the selection of appropriate Learning Objects can be realized. Nonetheless, in order to map Learning Objects to specific processes or tasks of daily business, process models that comprise the underlying business processes have to be extended as well. One possibility to assign Learning Objects is the usage of annotations, as displayed in Fig. 4. As shown in Fig. 4 multiple Learning Objects can be assigned to a single task (here Task A). Additionally Learning Objects can be assigned to multiple tasks (see Learning Object 2).
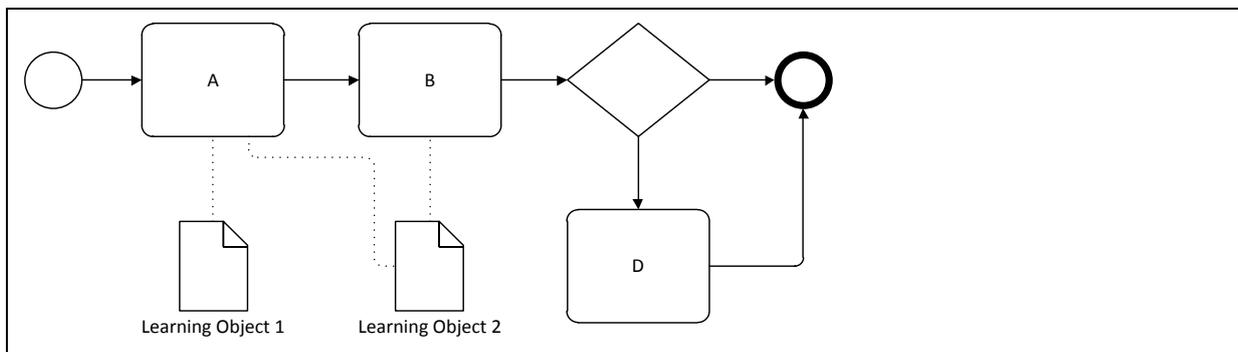

Fig. 4 – Sample Process with Learning Object Annotations

The assignment of adequate (human) resources for task execution depends on further information. As mentioned before each task is associated with certain requirements, such as specific roles, competences, skills or knowledge. So as to determine whether human resources are able to perform a task or not, all these requirements have to be modeled [5,8,9,13]. Based on these requirements and the individual human resource profiles adequate individuals can be identified. A sample process containing annotated task requirements as well as available Learning Objects is displayed in Fig. 5. The process specifies the creation of assessment objects within a Campus Management System. As

depicted in Fig. 5 the task "Create Assessment Version" requires the skill "Versioning" that is annotated to the task. If there is no human resource available that possesses the skill "Versioning" the annotated Learning Objects "LO – Versioning" and "LO – Create Version" can be utilized to fulfill the requirements in a second step. An individual within the pool of human resources can acquire the skill "Versioning" by successfully completing both Learning objects.
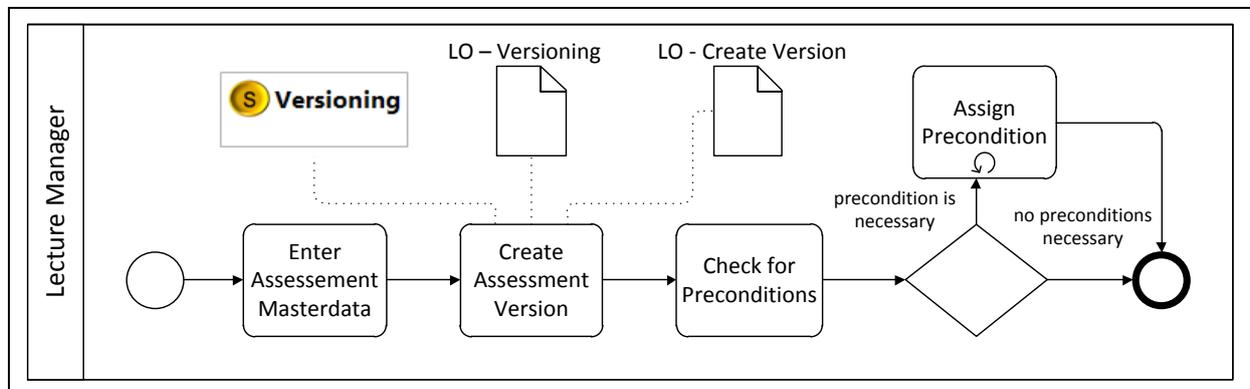

Fig. 5 - Sub process Create Assessment in the Business Process Create Degree Program within a Campus Management System

The shown approach simplifies the determination whether there are individuals within the human resource pool that comply with existing requirements or not. Moreover, adequate Learning Objects according to requirements are recommended. A direct integration of available Learning Objects into process oriented SaaS enterprise software is depicted in Fig. 6. However, the identification of which individual is the most suitable to perform a task or at first complete the associated Learning Object has to be based on further strategies. If, for instance, a frequently required competence or skill is only possessed by a single individual this individual is most likely not suitable for performing the Learning Objects with different goals of further education. The discussion of strategies for resources allocation (in this case combined with assignment of Learning Objects) is beyond the scope of this paper, see [13,18] for further information.
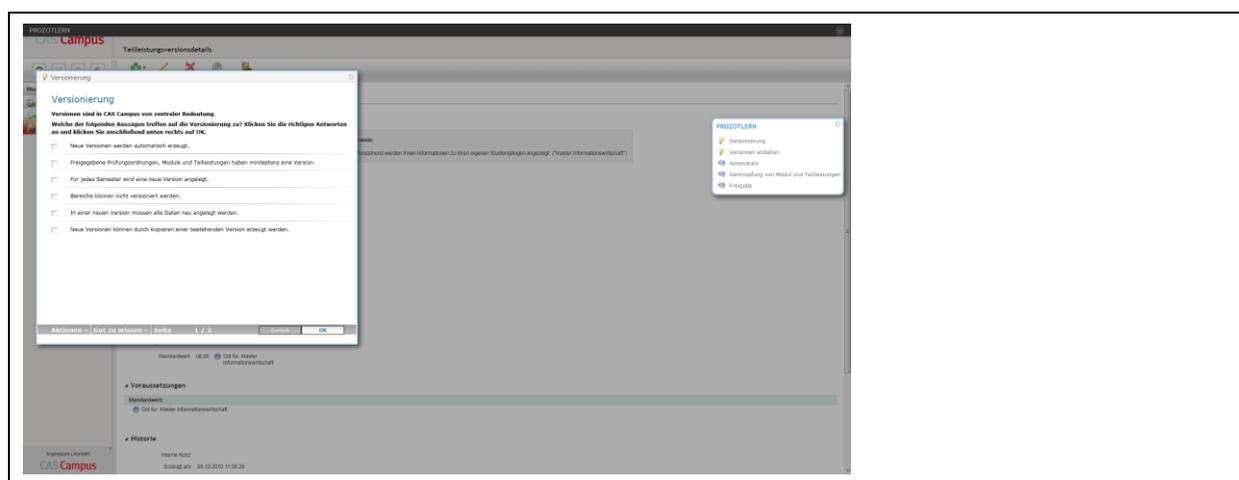

Fig. 6 - Integration of Learning Modules into a process oriented enterprise web application

Learning processes with Learning Object Annotations

The section before introduced an approach to assign Learning Objects to business process models with the intention to provide further education according to missing competences, skills and knowledge

necessary to execute a specific task. As mentioned before Learning Objects are small self-contained entities of learning content that focus on specific learning objectives. As the complexity of competences and skills may exceed the learning objective of single Learning Objects, there arises the need to connect multiple Learning Objects. Processes with annotated Learning Objects are one possibility to aggregate and structure Learning Objects that contribute to a competence, skill or knowledge. This process type can be considered as learning process. A sample learning process is depicted in Fig. 7.

Each task within the process is annotated with at least one Learning Object. The learning process depicted in Fig. 7 contains all Learning Objects needed to obtain the Skill "Lecture Management". By executing the process an individual will complete all Learning Objects annotated to the process. At the end of the learning process the individual will have acquired the skill "Lecture Management". A description of the annotated Learning Objects illustrated in Fig. 7 is given in Table 1.
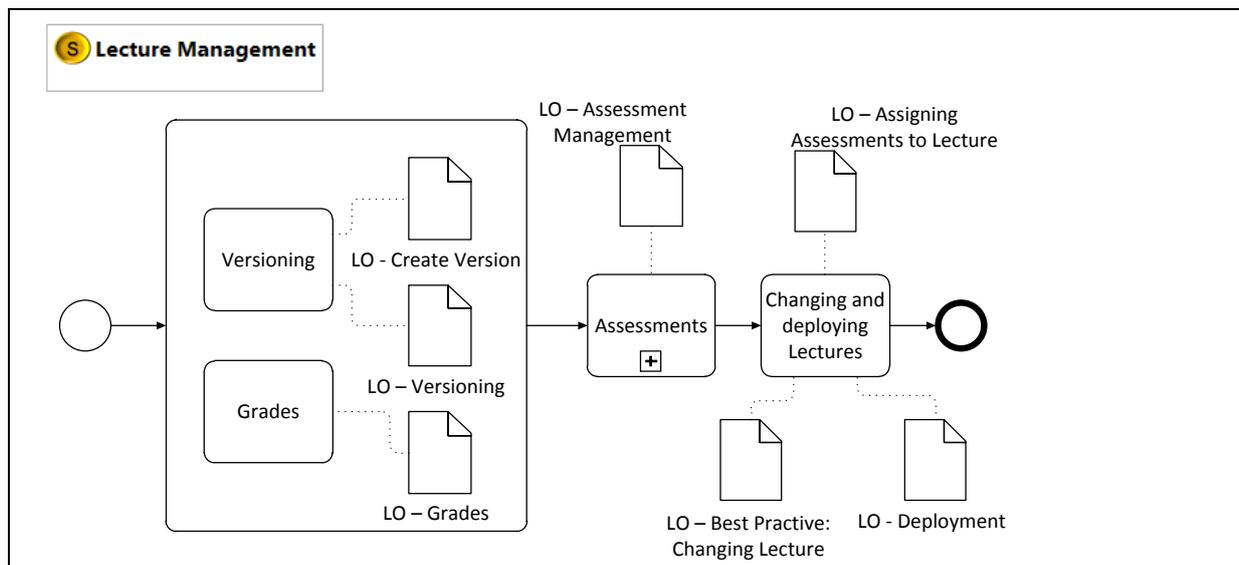

Fig. 7 – Learning Process with Annotated Learning Objects

Learning Object	Description / Objectives
Versioning	General Description of the concept of component versions within the Campus Management System.
Create Version	Learning Object on how create a version.
Grades	Introduction of different grading scales which are relevant for creating a Lecture.
Assessment Management	Complex aggregated Learning Object describing how to create, update and delete assessments within the Campus Management Software.
Assigning Assessments to Lectures	Learning Object describing how assessments have to be assigned to lectures.
Best Practice: Changing Lecture	Best Practice Guide demonstrating how existing lectures can be updated.
Deployment	Describes how the lecture has to be deployed on the production system

Table 1 – List of Learning Objects that contribute to the skill Lecture Management

Conclusion

In business partner networks data exchange between participating actors and the challenge to match available information of resource profiles has to be addressed. Standards to ensure exchange of competence requirements and definitions between organizations are needed. On basis of the presented resource modeling language (RML) resource profiles can be described and analyzed. RML demonstrates the potential of the combination and extension of known concepts in resource modeling and business process management. Competence and resource models of human resource departments can be re-used for the modeling of business process relevant requirements. Thus the execution of business processes can be competence driven and learning objects that describe required competences, skills and knowledge can be employed if necessary. Especially the domain of e-learning does allow dynamic allocation of learning objects, thereby simplifying the process of further education.

Within next future we plan to develop mechanisms for competence gap analysis and automatic aggregation of competence profiles in order to foster agile collaboration between business partners. Finally we strive to generate resource models automatically from existing data by the usage of transformation rules in regard to the goal oriented modeling guidelines.

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