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Knowledge-based extension of ITIL process models in ERP service support

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ABSTRACT

The following contribution shows a knowledge-based extension of ITIL process models in service support. Therefore existing process models will be extended with Knowledge Modeling and Description (KMDL®) objects and a knowledge level can be introduced. This enables the identification of information and knowledge flows. On the one hand this can be used to analyze knowledge-intensive service support processes. On the other hand the use of KMDL® enriched process models allows the design of process modules for target processes.

Keywords

Service Support, ITIL, KMDL®, knowledge-intensive business processes

INTRODUCTION

Nowadays Enterprise-Resource-Planning-Systems (ERP-Systems) are the key for successful information processing. However the critical phase is not finished after the installation of a system. In fact the operating phase is decisive for success because high running costs can exceed the start-up costs dramatically. Mistakes and inefficient process flows will cause a loss of time and unexpected costs. As a matter of principle an ERP-System can never be more efficient than the organization itself. Therefore target-oriented user qualification and efficient service support in daily business processes are very important. Furthermore a constantly increasing market dynamic is the reason for rapidly changing tasks which have to be fulfilled by the employees. Thus a quick and context oriented knowledge acquisition is the main factor for success for the company as well as for the profitability of the entire ERP software solution.

An IT infrastructure has to fulfill four fundamental requirements:

- High performance: The transaction of business operations has to be carried out very quickly within the ERP system. This means new inputs have to be processed promptly and cost-intensive time losses have to be avoided.
- High operational availability: Every operational interruption within the system will cause an immediate break of the process cycle in the involved organizational unit.
- Low costs: The running costs for an operating application are normally higher than the original price. Therefore they determine significantly the profitability of the IT solution.
- High adaptability: The adaptability of ERP systems has become an essential competitive factor. At the moment the methodical support to implement adaptability can be evaluated as insufficient. This leads to unused potentials in a powerful structure (Andresen, Gronau and Schmid, 2005).

Nevertheless a successful application is not only determined by system properties. In fact it depends on a high degree of the organizational ERP environment. For example the efficiency is affected by the correct configuration of the application environment and the understanding of the user for it as well. Only then cost-intensive errors caused by not available, but required information can be avoided. Furthermore the IT solution has to be adapted to continuously changing requirements. Therefore the process of order transaction has to be characterized by a high capacity of reaction to keep the ability for a flexible change of standard processes. Additionally it has to be assured that a loss of critical knowledge, which e.g. can be caused by the retirement of an employee, can be avoided and minimized respectively (Schuster, 2004).

A knowledge oriented organization includes methods and systems for the organization of information and knowledge which is expressed within the information. In this context the term “knowledge management” is very important. It aims at the identification and improvement of knowledge processing in the operative business processes and therefore contributes directly to the added value (Maier and Remus, 2003). A knowledge oriented ERP organization design includes the awareness of where specific knowledge and information is decisive during the business processes, where it can be found, preserved and extended. Efficient ERP-Systems have to enable an adaptive process execution. A flexible process modification has to be supported by the system. Additionally user problems have to be solved as quickly as possible to prevent operational faults. A knowledge oriented organization includes methods and systems for the organization of information and connected knowledge respectively, which is expressed with the help of this information. The application of knowledge management tools can make an important contribution to the design of a successful knowledge oriented ERP system organization. Thereby knowledge management intends the identification and development of knowledge work in the operative business processes and therefore contributes directly to the added value. Accordingly a company has to be able to generate, to save, to transfer and to increase knowledge in time and at the right place but still under the focus of adequate costs (Sydow and van Well, 1996). A quick, independent and contextual acquisition of ERP oriented knowledge is the crucial for the obtainment and maintenance of an operational excellence as well as for the profitability of the entire installation (Scherer, 2004).

Additionally the inter-organizational aspects of a knowledge oriented organization have to be considered. So far the consideration of knowledge was limited to intra-organizational structures. But an operative ERP system also includes inter-organizational aspects e.g. service support processes between user and software provider. These processes have to be integrated in the knowledge oriented ERP organization. It is a basic condition for a fast and reasonable processing of user problems, customization according to new requirements and the implementation of helpful suggestions (Thiesse, 2001).

An ERP system organization can not only be classified as highly knowledge intensive because of the inter-organizational aspects. Complexity, hardly structured business processes, communication oriented tasks, media diversity and a high quantity of involved persons show the high degree of knowledge intensity in an ERP organization. Therefore a method is needed which has the ability to detect and analyze these processes in a structured way. By introducing a knowledge and information level, the Knowledge Modeling and Description Language (KMDL®) method enables a specification, whenever knowledge of a certain form and content will be needed or generated during the business processes. With the help of KMDL® the event-driven description of a knowledge intensive process can be extended with information and knowledge objects as well as knowledge conversions which run parallel and between the business processes. Unlike other process modeling methods KMDL® considers explicit as well as tacit knowledge. Within the scope of a process analysis potentials can be identified with KMDL® process patterns and the results can be used for the design of reference processes in a knowledge oriented ERP organization.

Within the next paragraph the basic concept of KMDL® will be introduced. In a second step it will be shown how ITIL reference processes in service support can be extended with KMDL® objects and used for a pattern analysis as well as for the development of target processes.

KNOWLEDGE MODELING AND DESCRIPTION LANGUAGE

Currently the KMDL® (KMDL, 2006; Korf and Fröming, 2006) is available in version 2.0 (see Figure 1). The concept combines the two methods business process management and knowledge management in order to have a holistic view on the knowledge intensive business process. In knowledge intensive business processes the knowledge interaction of the participants within and amongst business processes is the main driver in order to achieve the desired outcome. To provide the desired representation mechanism KMDL® represents knowledge conversions within and between business processes. Information and knowledge are preconditions which present the input for a conversion. At the same time every conversion creates new information and/or knowledge. These information and knowledge respectively build the output of the conversion. Every knowledge conversion runs between information and knowledge objects. Thereby the form of conversion is determined by the input and output objects (internalization, externalization, combination, socialization). In KMDL® v2.0 there are three types of conversions:

- Atomic conversions: atomic conversions describe the smallest possible conversion. They possess exactly one starting and one arrival object and enable the exact identification of the origin of information and knowledge objects.
- Complex conversions: complex conversions consist of atomic conversions. They possess several starting and one arrival objects or one starting and several arrival objects. Like atomic conversions complex conversions enable the exact identification of the origin of information and knowledge objects. They can also be made of two parallel atomic conversions.
- Abstract conversions: abstract conversions possess several starting and several arrival objects. They can be understood as the sum of several occurring conversions, which do not have to be considered more closely. In this connection the identification of the origin of information and knowledge objects cannot be assured because knowledge as well as

information objects are included as starting as well as arrival objects. Therefore a precise classification and traceability cannot be given anymore. Frequently abstract conversions are used for process schemes.

One process step is like a classic task in the process description and it is composed of a set of single conversions. It is only a visual support to make clear that this complex conversion has been modeled more exactly. In every conversion there are persons (determined or undetermined), teams or information systems included and specific requirements can be made (e.g. business, methodical, social, operational, technical). These requirements are a precondition to realize the conversions and therefore to create the requested output. Every person who is involved in a conversion will be assigned to this conversion. The knowledge objects that are used during the conversion will be assigned to the person. Thereby persons as well as teams (teams consist of several persons) and indefinite persons (indefinite persons are used for should-be processes) can receive knowledge objects which are bound to persons and are characterized by its uniqueness. Knowledge objects are classified into four categories (business, methodical, social, operational) and they will be confronted with the requirements of the conversion. The attribute level describes the qualification of each knowledge object and requirement object. At present the attribute level contains four degrees: 0 means no knowledge, 1 means basic knowledge, 2 means intermediate knowledge and 3 means expert knowledge. Technical requirements cannot be covered by knowledge objects. Instead this has to be assured by an information system. Information systems are actors that create, combine, and categorize information. They do not possess knowledge objects but functions that can be confronted with technical requirements.

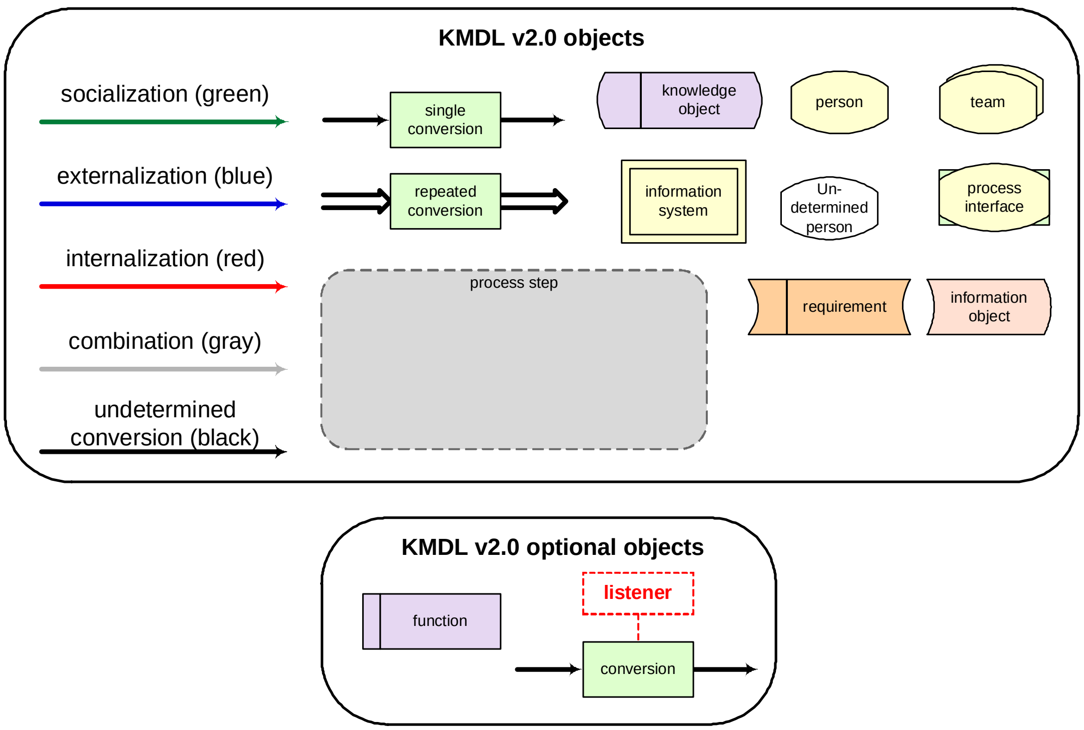

Figure 1. Associations and objects KMDL® v2.0

A closer description of KMDL® v2.0 objects is carried out on the basis of attributes. For instance every knowledge, information and requirement object will be assigned to the attribute “knowledge domain” and therefore to a specific topic, if possible. This enables a hierarchical connection of knowledge, information and requirement objects and also the presentation of explicit and tacit knowledge which is used during the considered process. The hierarchical connection can be illustrated in a taxonomy. Furthermore the description language enables a visualization of knowledge conversions. Following Nonaka/Takeuchi KMDL® distinguishes between four types of knowledge conversions (Nonanka and Takeuchi, 1995):

- Internalization: Internalization means the conversion of explicit knowledge into tacit knowledge. It is very closely related to learning-by-doing. Experiences made through socialization, externalization or combination are internalized and integrated into the individual’s knowledge framework. The internalization is started by an information object and ends with a knowledge object.

- Externalization: Externalization is understood as the transformation of tacit into explicit knowledge. The problematical aspect within this conversion is that important and person-bound parts will get lost because it is difficult or in some cases impossible to externalize tacit knowledge. The externalization is modeled by the connection of at least one knowledge object with an information object.
- Socialization: Socialization is a conversion from tacit knowledge of one person into tacit knowledge of another person. Often it is done by sharing experience: Just like apprentices of a craftsman learn their skills by observation, a knowledge-worker can learn required abilities through on-the-job training. The socialization does not demand for spoken or written words. Socialization is a directed graph from a knowledge object of one person to a knowledge object of another person.
- Combination: Combination is the conversion from explicit into explicit knowledge. During a combination one or more information objects are used to create a new information object. The association of at least two information objects and the generation of a new information object is called combination.

Unlike other process modeling tools the main focus of KMDL® is on the support of all four expressions of knowledge conversions (see Figure 2). It allows a systematical description of process knowledge and the identification of all the containing information. Origin and usage of knowledge and information can be defined as well.

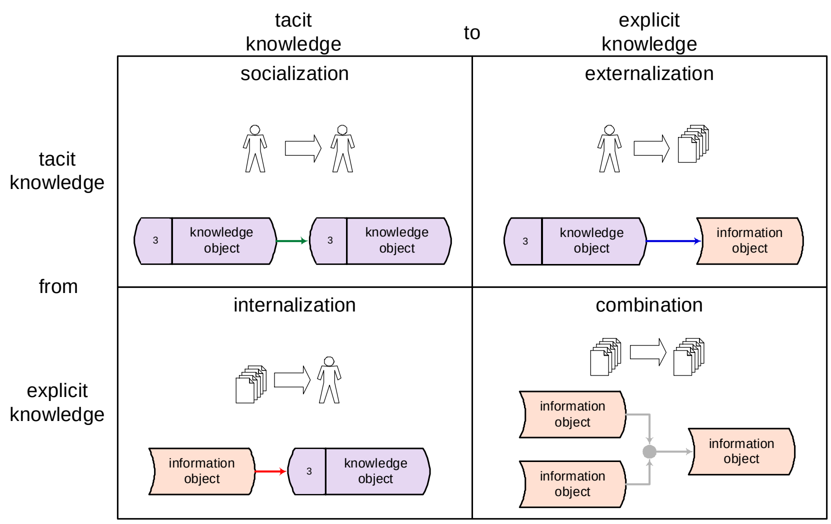

Figure 2. Model of the dynamics of knowledge creation

Detailed capturing of the knowledge-intensive business process is a precondition for the analysis and evaluation of potentials within the process. The analysis of the process comprises the identification of knowledge intensity, the process scheme and process potentials. As-is models illustrate the ownership, the demand, the development and the use of knowledge. Further it is possible to visualize the knowledge intensity as a knowledge map for the entire process, for a process part or for a single activity of the respective tasks. This procedure allows a classification of single tasks or the weighting of their relevance. The results are used for recommendations of technical and organizational improvements. The comparison of as-is models of different process instances of the same process is useful in order to generate universally valid statements about process elements and element relations. Selected knowledge based activities should be investigated to identify specific patterns. It is recommended to extend the existing reference processes with this information in order to support future participants of the process.

The effective and efficient knowledge transfer within and between processes is an important factor for success, especially for an early identification and estimation of risks. Besides the description of classical business processes KMDL® provides the systematical identification and analysis of knowledge flows and transformations. This allows the identification of knowledge monopolies, unused competencies, unsatisfied demands or necessary trainings. Thereby actions to improve the knowledge intensive processes can be performed.

K-MODELER TOOL

Simultaneously to the development of the Knowledge Modeling and Description Language the K-Modeler tool was designed and a prototype could be implemented. The K-Modeler is a modeling tool as well as an analyzer for knowledge intensive business processes. The tool automatically identifies and evaluates various design patterns in the modeled processes and thus helps to analyze the process. These process patterns are derived from known disadvantageous process elements and structures found in knowledge-intensive processes (Gamma et al., 1995). Furthermore process reports can be generated. The results can be taken as a basis for further analyses. Besides the basic functionalities the K-Modeler tool has the ability to look at a certain process from various perspectives ("process views"). Therefore the users have the opportunity to analyze knowledge intensive business processes depending on their specific demands.

As environment for the implementation of the K-Modeler the "Eclipse Framework" was selected to assure independence from the operating system and to increase the flexibility of the platform. KMDL® models can be created by using the drag and drop functionality of the K-Modeler editor. Thereby syntax errors will be indicated immediately. Furthermore additional information is presented in an "Eclipse View" of the modeled objects. An integrated process tree points out the structure of the processes with their sub-processes and aggregations. This structure can be generated as XML file and can then be exported into an HTML file for presentation in an intranet.

SERVICE SUPPORT PROCESSES IN AN ERP ORGANIZATION AS AN EXAMPLE FOR PROCESS ANALYSIS WITH KMDL®

Developed in the late 1980´s, the IT Infrastructure Library (ITIL) has become a world-wide standard in Service Management. Starting as a guide for UK government, the framework has proved to be useful to organizations in all sectors through its adoption by many Service Management companies as the basis for consultancy, education and software tools support (Office of Government Commerce, 2005a). IT Service Management describes all the actions which are needed for the best possible support of business processes within an IT organization. The primary objective of Service Management is to ensure that the IT Services are aligned to the business needs. The Service Management processes are divided into two core areas, Service Delivery and Service Support (Office of Government Commerce, 2005b). The ITIL Service Delivery book looks at what kind of service the business requires of the provider in order to provide adequate support to the business users. The ITIL Service Support book is concerned with ensuring that the customer has access to the appropriate services to support the business functions (Office of Government Commerce, 2005a). In the following paragraph the main topics of ITIL Service Support will be introduced. It will be shown how the existing ITIL reference processes can be extended by KMDL® objects and how this can be used to realize potentials.

ITIL differentiates between six components of Service Support (Office of Government Commerce, 2005a):

- Incident Management: The primary goal of the Incident Management process is to restore normal service operation as quickly as possible and minimize the adverse impact on business operations, thus ensuring that the best possible levels of service quality and availability are maintained. Examples of incidents are application bugs, system down and service requests (information/advice/documentation).
- Problem Management: The goal of Problem Management is to minimize the adverse impact of incidents and problems on the business that are caused by errors within the IT Infrastructure, and to prevent recurrence of incidents related to these errors. In order to achieve this goal, Problem Management seeks to identify the root cause of incidents and then to initiate actions to improve or correct the situation. Problem control, error control and proactive Problem Management are all within the scope of the Problem Management process.
- Configuration Management: Businesses require quality IT services economically. To be efficient and effective, all organizations need to control their IT infrastructure and services. Configuration Management provides a logical model of the infrastructure or a service. It covers the identification, recording, and reporting of IT components, including their versions, constituent components and relationships. Items that should be under the control of Configuration Management include hardware, software and associated documentation.
- Change Management: Changes arise as a result of problems, but many changes also come from seeking business benefits proactively, such as reducing costs or improving services. The goal of the Change Management process is to ensure that standardized methods and procedures are used for efficient and prompt handling of all changes, in order to minimize the impact of change-related incidents upon service quality, and consequently to improve the day-to-day operations of the organization.
- Release Management: Release Management takes a holistic view of a change to an IT service and should ensure that all aspects or a release, both technical and non-technical, are considered together. Release Management undertakes the

planning, design, build configuration and testing of hardware and software to create a set of release components for a live environment. Release Management activities also cover the planning, preparation and scheduling of a release to many customers and locations.

- Service Desk: The Service Desk acts as the central point of contact between service providers and users/customers, on a day-to-day basis. It is also a focal point for reporting incidents and performing service requests. The modern Service Desk is customer-facing and at the same time focused on its main objectives, which are to drive and to improve service to and on behalf of the business. At an operational level, its objective is to provide advice, guidance and the rapid restoration of normal services to its customers and users.

The extension of ITIL process models with KMDL® objects will be shown within the incident life cycle. The Incident Management process is mostly reactive. To react efficiently and effectively it demands a formal method of working. Figure 3 illustrates the activities during an ITIL incident life cycle (Office of Government Commerce, 2005a).

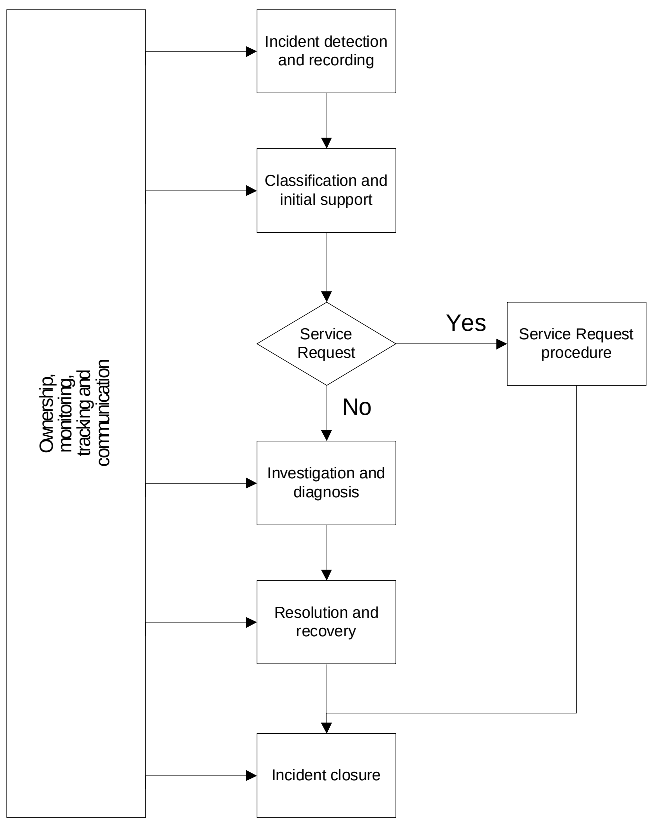

Figure 3. ITIL incident life cycle (Office of Government Commerce, 2005a)

By implementing ITIL Incident Management processes a couple of major benefits can be gained. A reduced business impact of incidents by timely resolution and thereby increasing effectiveness can be realized for the business as a whole. Furthermore there is a higher availability of business-focused management information related to the Service Level Agreements (SLA). Altogether there will be a strongly improved monitoring for the IT organization in particular. The elimination of lost or incorrect incidents and service requests will improve user and customer satisfaction. In contrast, failing to implement Incident Management may result in no one to manage and escalate incidents. Hence incidents may become more severe than necessary and adversely affect IT service quality. In addition specialized support staff will be subjected to constant interruptions, which will make them less effective (Office of Government Commerce, 2005a).

Although there are highly knowledge intensive parts in Incident Management, so far there is no consideration of the components 'knowledge' and 'information'. Merely a knowledge base in the form of an up-to-date problem/error database is suggested to provide for resolutions and work-arounds. By an extension of ITIL reference processes with KMDL® objects knowledge and information flows can be identified. Therefore a KMDL® process model will be laid behind the knowledge intensive ITIL process steps (Figure 4 for Incident detection and recording).

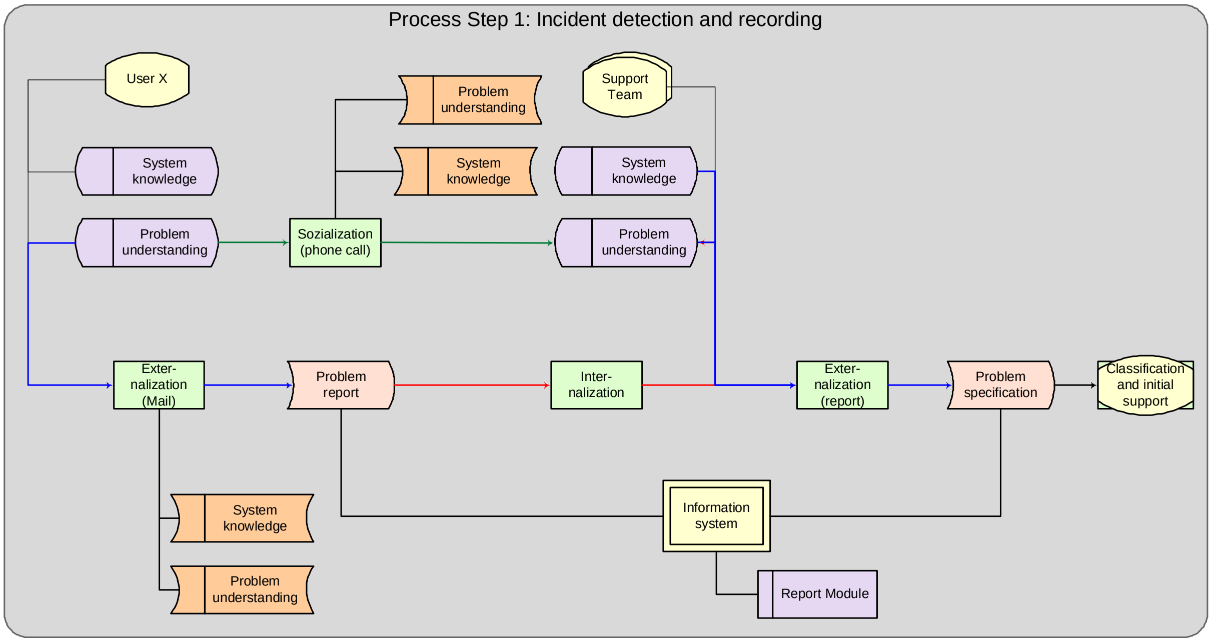

Figure 4. Example for ITIL Incident Management extension with KMDL® objects (Process Step 1: Incident detection and recording)

BENEFITS OF THE ITIL PROCESS MODEL EXTENSION WITH KMDL® OBJECTS

Based on existing ITIL process models the extension with KMDL® objects can be realized easily and quickly. The ITIL reference processes can be imported into the K-Modeler tool. The enrichment of these processes will be based on employee interviews and thereof a model of the current service management situation can be developed. Afterwards the K-Modeler tool automatically identifies and evaluates various design patterns in the modeled processes and thus helps to analyze these processes. The process patterns are derived from known disadvantageous process elements and structures found in knowledge-intensive processes (Brown et al., 1998).

The pattern concept was coined originally by the architect and mathematician Christopher Alexander. Patterns are an instrument to reuse knowledge and the idea of patterns is used to find solutions for recurring problems (Greenfiled, Short, Cook, Kent and Crupi, 2004; Kirchner and Jain, 2004). During the nineteen nineties the concept of patterns and best-practice solutions was transferred in sub areas of software engineering by Gamma et al. (Gamma et al., 1995). The principle of patterns is used in KMDL® to analyze knowledge intensive business processes (KDML, 2006). Thereby a single process pattern describes a specific situation which occurs repeatedly during these processes. A process pattern is an indicator for hidden process potentials and points out opportunities for an alternative process design. During several projects in the area of software engineering the research group ‘Knowledge Management’ of the University of Potsdam could identify a multitude of patterns. Various different process instances were modeled which showed the same process structures in many cases. By analyzing these structures the following five pattern categories could be identified (see Figure 5) (Bahrs, Bogen and Schmid, 2005):

- Occurrence patterns: The pattern of occurrence shows where specific objects appear with exceptional frequency in the business processes. For example if a specific person shows up very often in the processes this could be a clue for a mighty monopoly. The pattern can show that one person holds knowledge of high process relevance and this can lead to big problems if the person e.g. resigns from office. A better responsibility assignment can be an idea for improvement. The pattern can be used not only for the occurrence of persons but also for information, knowledge objects, requirements and conversions.

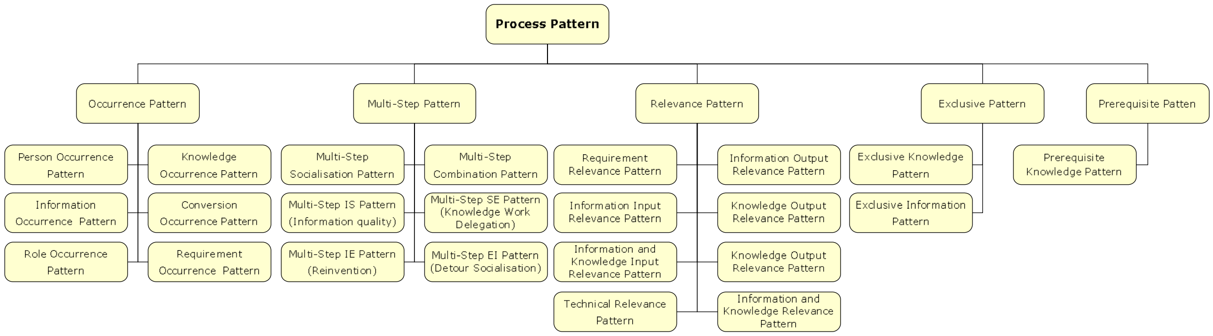

Figure 5. KMDL® Process Patterns

- Multi-step patterns: The multi-step pattern category describes a combination of two knowledge conversions, whereby transitions from tacit to the explicit process level and vice versa will be analyzed. There is also an examination of conversion doubling on the same level. Twelve different combinations of knowledge conversions are imaginable, but only the included patterns show potentials in the process design. The multi-step socialization pattern is an example of a multi-step pattern where information gets lost during a double socialization ("Chinese Whisper").
- Relevance patterns: Relevance patterns refer to process steps with a high degree of complexity and knowledge intensity. There are four types of relevance patterns that indicate tasks with a great amount of input (knowledge objects, information objects), output (knowledge objects, information objects), integrated persons or task requirements. A suggestion for improvement can be a process step reorganization and therefore the creation of smaller process steps, which run parallel and sequential.
- Exclusive patterns: Two types of the exclusive pattern category are distinguished: exclusive information or exclusive knowledge pattern. Thereby it is shown that there are certain information or knowledge objects in the business process which are requested very frequently. The loss of these process relevant objects can lead to a process disruption. Therefore the information or knowledge has to be secured, for example by externalization of specific knowledge objects.
- Prerequisite pattern: The prerequisite pattern describes a process involved person, which only has the ability to fulfill a task after the generation of knowledge through socialization with a non-involved person. The informal acquisition of knowledge depends on personal preferences and the personal social network. A method of resolution can be the institutionalization of the knowledge transfer.

Normally these critical points cannot be identified at a first glance during the process. Therefore the modeling of service management processes with KMDL® is an important step to point out potentials and weaknesses. As soon as critical points are found, proposals for solutions can be made. This is an efficient way to identify and to work out potentials systematically.

A second way for the use of KMDL® enriched process models is the use of process modules for target processes. In future projects KMDL® best practice modules based on ITIL, will be developed which enable a fast composition for service processes like Incident Management, Problem Management, Change Management, etc. Comparable to a construction kit, the ERP users can arrange their individual service processes easily. Due to changing requirements, the process models can be customized uncomplicated and therefore it will be possible for companies to organize their ERP processes dynamically and adaptable.

CONCLUSION

The knowledge-based extension of ITIL reference processes offers two important opportunities: On the one hand the analysis of existing service management processes by using process patterns and on the other hand the design and development of target processes. The focus of further research during the next months will be especially in this area. Therefore a committee was founded consisting of several ERP service suppliers and research groups. Within this committee important problems of a complex ERP system environment will be discussed and best practice process models will be developed. For a verification the implementation of the process models will be tested in a real-life environment.

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