Using UML for Web Site Requirements Engineering

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1. CREATING A WEB SITE MEANS DEVELOPING SOFTWARE

From a strategic point of view, the typical target groups of a company in e-business are the same as in traditional business: the customers (business-to-consumer), the business partners (business-to-business) and within the company itself (business to employee). A company makes its target groups aware of its presence on the electronic market by creating an individual web site on the World Wide Web [Schwi98a;b].

Technically a web site is a collection of interrelated pages (user interfaces), in which the target groups can access both passive information and interactive applications using a navigation system. A web site is created using programme code, is based on system software and requires hardware. It therefore has the same basic characteristics as software. A web site is designed individually for each company and can therefore be seen as individual software [Schwi98b].

As a whole, a web site is therefore a complex software product, which boosts a company´s business performance by increasing market visibility. A web site´s high level of economic importance makes it necessary to plan and develop it systematically. This type of software engineering for web sites is called web site engineering (WSE). The WSE component model in diagram 1 also integrates the structure of a corporate web site environment (components 1 and 2) and a procedure model (component 3) in order to develop a web site [Schwi98c].

The initial analysis of a web site´s requirements is crucial, in particular for the development of the „web site" software product. The objective of this research project is to create a consistent method for the analysis of web site requirements, to make this method operational using concepts from unified modeling language (UML) and to explore its suitability with web site development projects.

2. ENGINEERING WEB SITE REQUIREMENTS

The extent to which a web site boosts company performance will depend on whether it fulfils the target groups' (cus-tomers, business partners and employees) requirements. As a result, it is necessary to determine the target groups' web site requirements and systematically exploit them in order to draw up basic guidelines for the web site development process [Wi99]. Requirements engineering (RE) is the systematic exploitation of software requirements (determining, describing, analysing and reviewing). When developing a target group-oriented web site, RE is carried out, taking into account web site-specific characteristics. In this respect, web sites can not be classified in the usual application software categories, e.g. administration and reserve systems, executive information systems, workflow management systems. A series of fundamental characteristics distinguish a web site from these „traditional" applications [Schwi97]:

· Web Sites are very communication-oriented.
· The „look and feel" aspect of a web site is essential.
· Web sites address a broader and more heterogeneous target group.
· Web sites change constantly.
· Lasting market presence involves permanently adapting and maintaining a site.
· As a rule, a web site integrates several different applications under one uniform interface
· Experts with a broad range of specialist backgrounds are involved in developing a site.

If a corporate web site is perceived to be market presence created entirely by software, the business requirements (e.g. maintaining and enhancing competitiveness and generating turnover) are of ultimate importance [Par98]. The organisational and technical requirements are then derived from these. The business requirements of "market presence web sites" are a lot more complex and varied than for traditional application systems [Wi00]. When dealing with this level of complexity and variety, requirements engineering should be carried out systematically, taking into consideration the web site-specific characteristics.

The WSE component model (diagram 1) integrates web site-specific requirements engineering (WSRE) in its procedure model. In order to define the business requirements, we have applied the requirements engineering life cycle, commonly used in traditional software engineering [Kü+87] (diagram 2 [SchwiWi99]). This life cycle shows us how the tasks – determining, describing, analysing and reviewing the requirements – are linked in an iterative process.

If the requirements are to be determined systematically, suitable methods must be applied in order to carry out the key tasks. It is particularly important that these methods:

· are adapted to the web site-specific characteristics,
· help find out the business requirements for a web site [Wi00].

A methodical *description and analysis of the requirements* makes it possible to determine the requirement specifications in a consistent and comprehensive way. Efficient support requires a method to achieve:
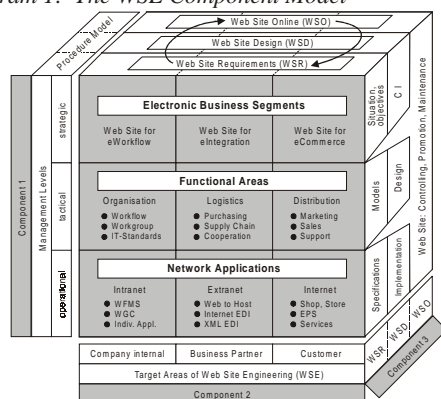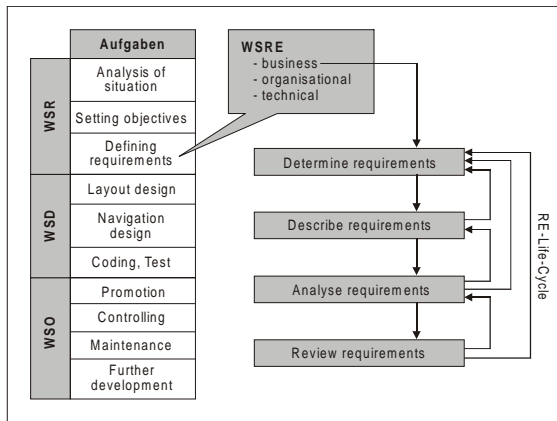
Diagram 1: The WSE Component Model

Diagram 2: Integration of the RE Life Cycle into the WSE Component Model

·   a comprehensive and consistent description and analysis of business requirements,
·   explicit target group orientation within the development process,
·   a transparent presentation of the tasks to be fulfilled by the web site,
·   as well as an up-to-date execution of the business requirements [Wi00].

We have developed and implemented such a method using UML, as described below.

3. WEB SITE REQUIREMENTS ENGINEERING WITH UML

A method for engineering business requirements is generally based on the following elements: specification framework [Schie95], procedure model [Stei94] and technology [Schie95]. A suitable method which systematically carries out the key tasks „description and analysis of requirements" requires *a specification framework.* This tool defines the fundamental business aspects of web sites. Its successful implementation constitutes the central business requirement specification for all web sites. The fundamental business aspects can be identified as follows (see diagram 3) [Wi00]:
·   Target groups,
·   Relevant business environment of a „web site" system,
·   Integration and transparent presentation of areas of responsibility and processes,
·   Illustration of tasks,
·   Contextual support of tasks and activities.

Diagram 3: Specification framework for the fundamental business aspects of web sites
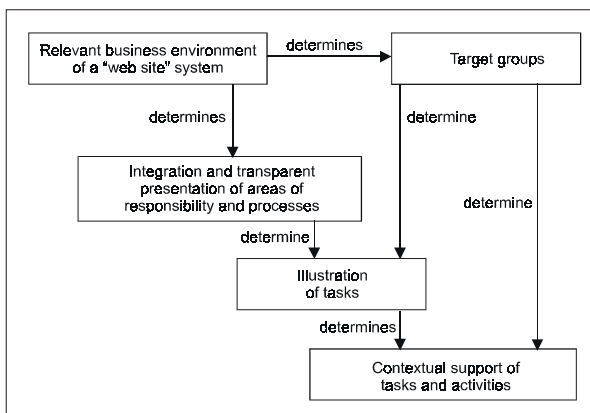
The function of a *procedure model* is to determine a sequence of sub-tasks (steps) for a stringent and target group-oriented description and analysis, which results in consistent and comprehensive business requirement specifications. The procedure model must also take into consideration the web site´s fundamental business aspects and their relationships with one another. The sub-tasks are derived from the aspects. The sequence of the sub-tasks is determined by the relationships between the aspects, classified from top to bottom. The method of approach (step 1 to 8) shown in diagram 4 is therefore developed on the basis of these elements.

In this context, a *technology* can be defined as a collection of concepts (e.g. data flow diagram, *class*), whose function is to describe and analyse the requirements in conformance with the fundamental business aspects of web sites. UML is capable of doing this and, as it is an object-oriented technology, it can process complex and dynamic requirements. The generally clear presentation forms of UML concepts (e.g. use case, actor) actively help involve the target groups in the development process. UML therefore appears to be predestined for the development of target group-oriented web sites. The UML concepts described below are suitable for the representation of fundamental business aspects of web sites (see diagram 3) and target group characteristics [Wi00].

Actor / actor diagram
The target groups are presented in a model as the future users of the web site (an application to be developed) by these concepts [BaHei96].

Package
Package can represent the "relevant business environment of a web site system" aspect, as dependencies between system elements [FowSco98], in this case between a web site (or parts of it) and fundamental elements of the surrounding system, can be illustrated at a high level of abstraction.

Use case
Its function is to represent types of tasks and processes (i.e. task areas or processes), which are to be supported by the application system to be developed [Oest98]. The use case concept therefore appears to be explicitly suitable for representing the "illustration of tasks" aspect.

Use case diagram
Use case diagram helps present the links between task areas or processes within the same business area [Oest98]. It is therefore suitable for the presentation of the "integration and transparent presentation of areas of responsibility and processes" aspects.

Use-case-step-graph
This extension of the "activity diagram" concept [Win00] aims to present the sequence of the steps which need to be carried out in order to execute a task. It shows the following:
·   which steps should be supported and which should not be supported by the application system which is to be developed,
·   which actors are responsible for which steps [Win99; 00].

Use-case-step-graph therefore has a dynamic approach which adequately presents the "contextual support of tasks and activities" aspect.

Detailed business class

Detailed business class is the equivalent of the object-oriented basic class concept. Its objectives are to identify the elements – their characteristics and their links – which constitute a task in detail. The detailed business class concept can therefore represent the "contextual support of tasks and activities" aspect from a detailed static angle. Detailed business classes are derived from business classes [Oest98].

Business class

The business class concept can be seen as a specialisation of the object-oriented basic class concept. The objective of this specialisation is to identify the basic elements which constitute a task and their interrelations. Business classes are an aggregation of detailed business classes [Oest98]. This concept can therefore be used to represent the "contextual support of tasks and activities" aspect from an approximate static angle and offer a target group-oriented presentation of identified classes [Oest98].

Diagram 4 combines the derivations from the specification framework, the procedure model and the technical UML concepts described above in a method for business requirements engineering of web sites.

Diagram 4: Procedure model and technology for the description and analysis of requirements

Step	Task	Result(s)	UML concept	
1	Prepare application of method	Uniform domain terminology, user groups	----------------	
2	Requirements as regards the relevant business web site environment	Business environment model	Package	During all steps, permanent analysis of the specifications (returns to previous steps are possible) and extension of domain terminology
3	Characteristics of the web site target groups	Participation model	Actor	
4	Describe the business requirements as regards the links between task areas or processes within the same business area to be shown	Integration / transparency model	Use case diagram	
5	Describe the business requirements as regards the tasks or processes to be shown	Task model	Use case	
6	Describe the business requirements as regards the sequence of the tasks to be shown	Dynamic context model	Use-case-step-graph	
7	Describe the business requirements as regards the detailed structure of the tasks to be shown	Detailed static context model	Detailed business class	
8	Describe the business requirements as regards the basic structure of the tasks to be shown	Approximate static context model	Business class	

Diagram 4: Procedure model and technology for the description and analysis of requirements

4. CONCLUSIONS AND OUTLOOK

We have interpreted a corporate web site to be a highly complex and dynamic software product which is developed in the following engineering phases: planning, modelling and implementation. In this respect, web site development is not very different from traditional software development. But this does not mean that there aren´t any differences. Due to its external impact, a corporate web site has a much higher direct influence on a company´s performance than administrative company-internal applications. The resulting web site-specific characteristics, such as a high level of customer focus, necessitate the implementation of specially adapted methods, in particular in the important early phases such as planning and modelling. In our research we have demonstrated how this type of specialist method can be deducted and developed. At the same time, we have put together a consistent package of practical tools from a series of UML concepts for the application of the method. Our remaining research will involve extending and fine-tuning the method and testing it in practice with real problems.

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