TOWARDS A QUALITY EVALUATION FRAMEWORK FOR MODEL-DRIVEN WEB ENGINEERING METHODOLOGIES

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Abstract: Various development methodologies currently exist in the field of Model-Driven Web Engineering (MDWE). Given the high number of methodologies available, it is necessary to evaluate the quality of the existing methodologies and provide helpful information to the developers. Furthermore, proposals are constantly appearing and the need may arise not only to evaluate the quality but also to find out how it can be improved. This article presents the work being carried out in this field and describes tasks to define a Quality Evaluation Framework (QuEF) to evaluate, under objective measures the quality of Model-Driven Web Engineering methodologies.

1 INTRODUCTION

Model-Driven Engineering (MDE) is a paradigm of software development that consists of the creation of models closer to a particular domain rather than concepts or a specific syntax. The domain environment specific to MDE for web engineering is called Model-Driven Web Engineering (MDWE). The Object Management Group (OMG) has developed the standard Model-Driven Architecture (MDA) which defines an architecture platform for proposals based on the Model-Driven paradigm[1].

The concept of platform independence appears frequently in MDA. Models may have the quality of being independent from the characteristics of any technological platform. By applying this paradigm, the lifecycle of a software system is completely covered, from requirements capture to its own maintenance, through the generation of the code. In recent years, the growing interest in the internet has led to the generation of a high number of proposals (W. Schwinger et al., 2008) which offer a frame of reference for the Web environment. On the other hand, there are a high number of approaches without standard consensus, a lack in the use of standards, and scarcity of both practical experience and tool support. In the face of this situation, an important need to assess the quality of existing methodologies arises. In this paper, therefore, an environment for the quality evaluation of Model-Driven Web methodologies based on MDA is proposed.

The paper is organized into the following sections. In Section 2 a global analysis of the situation is presented. Section 3 presents the problem, motivation and goal, and is intended to lay the basis of a framework that allows evaluate the quality of different methodological proposals. In Section 4 concepts such as framework and MDWE methodology are explained and the elements which define the Quality Evaluation Framework (QuEF) are provided. Finally, in Section 5, a set of conclusions, contributions and possible future work are given.

2 RELATED WORK

2.1 Surveys

There are many proposals in the area of MDWE and numerous comparative studies (Pérez, et al, 2007), (Escalona and Aragón, 2008), (Kroiβ and Koch, 2008). Along these lines, (Schwinger et al., 2008) must be considered, which specifically considers modelling concepts for their ubiquitous nature, together with an investigation of available support for Model-Driven Development in a comprehensive way, using a well-defined as well as fine-grained catalogue of more than 30 evaluation criteria.

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2.2 Quality Evaluation

In (Cachero et al., 2008), an approach is proposed to evaluate Web quality that provides all the elements which, according to the ISO/IEC 14598, are essential parts of a software quality evaluation. The idea of developing a MDE framework for evaluating quality has been applied in various studies of (Mohagheghi et al.), where it is stated that the quality of models is affected by the quality of different factors.

2.3 Software Metrics

In the literature there are numerous references to metrics (Etien and Rolland, 2005), (Briand et al, 2006), according to which, software measurement integration could be achieved by adopting the MDA approach. To this end, an approach is described in (Garcia, et al, 2007) for the management of measurement of software processes. From the methodological perspective, software measurement is supported by a wide variety of proposals, the ISO 15539 and IEEE 1061-1998 standards deserving special attention. As far as web metrics quality is concerned, in (Calero et al., 2005) some important metrics proposed for web information systems are classified.

3 PROBLEMS, MOTIVATION AND GOALS

The main goal of this research is to lay the basis of a QuEF that facilitates the quality assessment of different methodological proposals under some specific criteria. Today's modern web information systems are called to manage a huge amount of information which is difficult to develop and maintain. In this sense, there is a need for the suitable design of MDWE methodologies and effective tools. In this way, our work concentrates on evaluating and comparing existing proposals. One aspect that must be considered is the use of a MDWE methodology and its influence on the final product quality. Nowadays, it is important in the software industry to produce faster, cheaper software of higher quality.

4 DEFINING A QUALITY EVALUATION FRAMEWORK FOR MDWE METHODOLOGIES

4.1 The Term "Methodology"

An approach or methodology is a Model-Driven proposal for the development of web applications. It may provide a set of guidelines, techniques, processes and/or tools for the structuring of specifications, which are expressed as models. Only web modelling approaches which are based on MDA in the framework are considered.

4.2 The Term "Framework"

The QuEF is a basic conceptual structure composed of a set of elements used to evaluate MDWE methodologies. Therefore, a QuEF with a set of elements based on existing literature is proposed where four components for the evaluation of the quality of MDWE methodologies can be seen:

- *Approach Characteristics Template:* This component would have the responsibility of describing the input methodology characteristics to be evaluated.
- *Thesaurus & Glossary:* This component would be responsible for improving the standardization of the access channel and communication between users of different MDWE methodologies.
- *Quality Model:* This component is responsible for providing the basis for specifying quality requirements with the purpose of evaluating quality.
- *Quality Evaluation Process:* This component would have the responsibility of carrying out the quality evaluation process.

4.3 A QuEF for MDWE Methodologies

We present the steps for defining a QuEF for MDWE methodologies.

1. Identifying quality factors and quality attributes
2. Identifying approach characteristics and subcharacteristics that can affect the quality attributes.
3. Specifying how to evaluate the subcharacteristics.

4. Specifying association links between the subcharacteristics and the quality attributes.
5. Defining the Quality Evaluation Process.

Concepts, tasks to be performed for each step, and framework structuring and components which result for each step are described. The main component for the QuEF is the Quality Model. As shown in Figure 1, a Quality Model is a set of characteristics, subcharacteristics and metrics, quality factors, quality attributes and the relationships between them, which provides the basis for specifying quality requirements and evaluating quality. In simple terms all the stakeholders must be well-informed of what is expected, what the subcharacteristics to be achieved are, which impact should be achieved on quality attributes, what the evaluation criteria are and how these criteria can contribute towards achieving the goal.

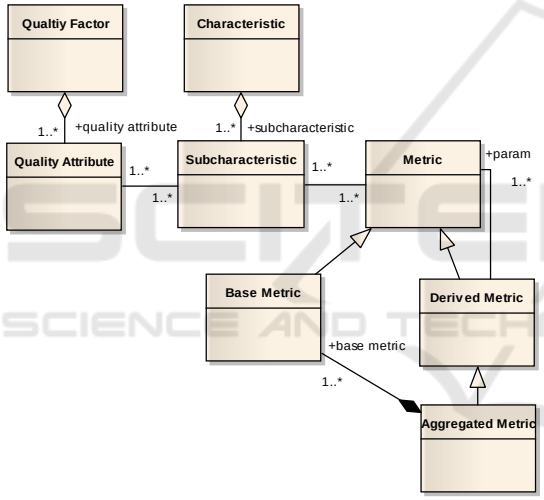

Figure 1: Quality Model metamodel.

On the other hand, in the *Approach Characteristics Template* component, a template is defined with general approach characteristics and subcharacteristics for each characteristic based on the Quality Model. It is used to describe an input methodology. This template would be used as input to the QuEF.

Therefore, for our purposes, a Quality Model contains a minimal amount of characteristics and subcharacteristics through which any kind of MDWE approach can be evaluated. In order to define a Quality Model, it contains association links between the subcharacteristics and the quality attributes. These association links represent the dependencies between *subcharacteristics* and *quality attributes*. They show *quality attributes* which are affected by *subcharacteristics* or the areas of the methodology that will be significantly affected if the approach is changed. Association links may be based on proven and real-world experience. Furthermore, *subcharacteristics* have to define quantitative or qualitative *metrics* which may be used to measure each *subcharacteristic*.

4.3.1 Identifying Quality Factors and Quality Attributes

Examples of quality factors are maintainability, usability or portability. In this sense, a set of quality factors and quality attributes based on current literature (for example, based on ISO/IEC 9126-1) and adapted to MDWE methodologies have to be identified, classified and hierarchical. Therefore, an important element for the QuEF is the *Thesaurus & Glossary* component. A thesaurus is a list containing the "terms" used to represent concepts, themes or contents of documents in order to make a terminological standardization to improve the access channel and communication between users of different MDWE methodologies.

4.3.2 Identifying Approach Characteristics and Subcharacteristics that can Affect the Quality Attributes

A characteristic or subcharacteristic is a feature assigned to a product, process or technique of a methodology, and hence is generally a set of user needs or expectations of a methodology. The characteristic is a higher-level concept and the subcharacteristic is a lower-level concept.

In MDWE, models are refined progressively and transformed into new models or code with tools. Moreover, each methodology may define its development process and/or techniques.
The idea is to characterize the whole MDWE process.

4.3.3 Specifying How to Evaluate the Subcharacteristics

For each subcharacteristic, a specification of its evaluation is necessary. For example, the evaluation may be via measuring quantitatively by metrics or subjective evaluation, inspections using checklists or interviewing the users or designers.

4.3.4 Specifying Association Links between the Subcharacteristics and the Quality Factors

In this step, the association links between subcharacteristics and quality attributes have to be defined. Association links indicate which quality attribute is affected for each subcharacteristic.

4.3.5 Defining the Quality Evaluation Process

A new component is defined, the *Quality Evaluation Process* component, which contrasts the information from each input Approach Template Characteristic with information from the Quality Model. The idea is to determine which aspect needs to be improved on MDWE methodology. it may be necessary to establish a decision criterion. The results provide an assessment report of the methodology and this may be used for contrasting with the evaluation of other MDWE methodologies.

5 CONCLUSIONS & FUTURE WORK

The bases of a Quality Evaluation Framework (QuEF) for MDWE methodologies are proposed in this paper. With regards to the contributions obtained from this research we think that the use of a QuEF would enhance the quality of products, processes and techniques of MDWE approaches.

Therefore the use of a QuEF may improve the efficiency and effectiveness of MDWE methodologies, and in turn may make their use more widespread. This framework would help designers to ask the right questions and solve critical issues.

The steps for defining the QuEF have to be followed. Besides, it would be necessary to carry out a standardization of terminology to improve the access channel for communication in MDWE. A software prototype would be developed to put it all in practise.

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