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SELECTED PAPERS BOOK

A number of selected papers presented at ICSOFT 2008 will be published by Springer-Verlag in a CCIS Series book. This selection will be done by the Conference Co-chairs and Program Co-chairs, among the papers actually presented at the conference, based on a rigorous review by the ICSOFT 2008 program committee members.

FOREWORD

This volume contains the proceedings of the third *International Conference on Software and Data Technologies* (*ICSOFT 2008*), organized by the Institute for Systems and Technologies of Information, Communication and Control (*INSTICC*) in cooperation with the Interdisciplinary Institute for Collaboration and Research on Enterprise Systems and Technology (IICREST), and co-sponsored by the Workflow Management Coalition (WfMC).

The purpose of this conference is to bring together researchers, engineers and practitioners interested in information technology and software development. The conference tracks are "*Programming Languages*", "*Software Engineering*", "*Distributed and Parallel Systems*", "*Information Systems and Data Management*" and "*Knowledge Engineering*".

Software and data technologies are essential for developing any computer information system, encompassing a large number of research topics and applications: from programming issues to the more abstract theoretical aspects of software engineering; from databases and data-warehouses to management information systems and knowledge-base systems; Distributed systems, ubiquity, data quality and other related topics are included in the scope of ICSOFT.

ICSOFT 2008 received 296 paper submissions from more than 50 countries in all continents. To evaluate each submission, a double blind paper evaluation method was used: each paper was reviewed by at least two internationally known experts from ICSOFT Program Committee. Only 49 papers were selected to be published and presented as full papers, i.e. completed work (8 pages in proceedings / 30' oral presentations), 70 additional papers, describing work-in-progress, were accepted as short paper for 20' oral presentation, leading to a total of 119 oral paper presentations. There were also 40 papers selected for poster presentation. The full-paper acceptance ratio was thus 16%, and the total oral paper acceptance ratio was 40%.

In its program ICSOFT includes panels to discuss aspects of software development, with the participation of distinguished world-class researchers; furthermore, the program is enriched by several keynote lectures delivered by renowned experts in their areas of knowledge. These high points in the conference program definitely contribute to reinforce the overall quality of the ICSOFT conference, which aims at becoming one of the most prestigious yearly events in its area.

The program for this conference required the dedicated effort of many people. Firstly, we must thank the authors, whose research and development efforts are recorded here. Secondly, we thank the members of the program committee and the additional reviewers for their diligence and expert reviewing. I would like to personally thank the Program Chairs, namely Boris Shishkov and Markus Helfert, for their important collaboration. The local organizers and the secretariat have worked hard to provide smooth logistics and a friendly environment, so we must thank them all and especially Ms. Monica Saramago for their patience and diligence in answering many emails and solving all the problems. Last but not least, we thank the invited speakers for their invaluable contribution and for taking the time to synthesize and prepare their talks.

A successful conference involves more than paper presentations; it is also a meeting place, where ideas about new research projects and other ventures are discussed and debated. Therefore, a social event including a conference diner was organized for the evening of July 7 (Monday) in order to promote this kind of social networking.

We wish you all an exciting conference and an unforgettable stay in the cosmopolitan city of Porto. We hope to meet you again next year for the 4th ICSOFT, to be held in the charming city of Sofia (Bulgaria), details of which will be shortly made available at http://www.icsoft.org.

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AlpeshKumar Ranchordas

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POSTERS

SPECIAL SESSION ON APPLICATIONS IN BANKING AND FINANCES

EVALTOOL
A Flexible Environment for the Capability Assessment of Software Processes

Tomás Martínez-Ruiz, Eduardo León-Pavón, Félix García, Mario Piattini
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Keywords: Software Process Assessment, Software Process Improvement, Process Reference Model, Process Assessment Model, Process Capability.

Abstract: Software process improvement is an important aspect in achieving capable processes, and so organizations are obviously concerned about it. However, to improve software process it is necessary to assess it in order to check its weaknesses and strengths. The assessment can be performed according to a given assessment process or any other and the processes of the organization can also use one particular process model or any other. The goal of this work is to provide an environment that allows us to carry out assessments that are in accord with various different process assessment models, on several process reference models. We have developed an environment composed of two components; one of these generates the database schema for storing the process reference model and assessment information and the other one assesses the process with reference to this information, generating results in several formats, to make it possible to interpret data. With this environment, assessment of software process is an easy task, whichever assessment process is used, and regardless of the process model used in the organization.

1 INTRODUCTION

Quality is the most effective way to introduce any product into the buyers' market at the present time. Furthermore, due to the importance of software products in our daily life, quality is a decisive factor in guaranteeing that products are able to do their jobs properly.

Software development organizations know the importance of this aspect and they are indeed interested in the quality of software products they create (Piattini, Garcia, & Caballero, 2006). But the quality of a product depends on the capability of the processes in which this product is created. Process capability is therefore an essential characteristic and there are two factors in this- one is image and the other is sheer need. They have to project a positive image if they are to export the software they produce and they need to turn their projects into effective and efficient ones.

Improvement of software processes is the way to maximise both factors. Three elements are needed when carrying out a process improvement initiative; a process improvement method, a process reference model and a process assessment method (Pino, García, & Piattini, 2008). In this respect, several organizations have been working on software process and their capability, as well as on several ways to evaluate and improve them. Figure 1 shows the quagmire with several process models and assessment methods, together with their interrelations.

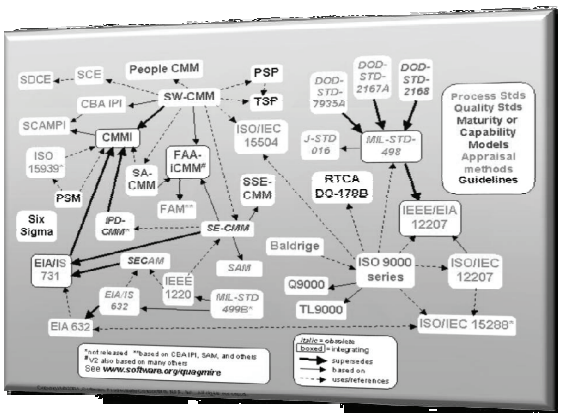

Figure 1: Software process quagmire (www.software.org /quagmire).

However, given the importance of assessing the processes before, during and after the improvement has been performed, several tools have been developed to help users assess processes. These tools can carry out repetitive actions, by reducing the cognitive charge of people involved in the assessments, and they can perform most of the management tasks that were done manually.

The diversity of existing software process models and assessment methods has led to the development of tools for the evaluation of the processes of each process model with reference to each assessment method. Each one of these tools depends on the appropriate process and assessment method.

In this paper we present an environment that is able to evaluate processes following any process reference model and any assessment method. This environment provides companies with the technical support necessary to carry out and store the results of their assessments in an integrated and consistent way. And it also avoids the development of specific tools for assess following each new assessment method or each new process reference model. With this environment, assessing software processes can be conducted automatically and in a flexible way by using a generic structure and assessment procedures. This avoids having to use diverse tools to conduct process assessments according to specific process reference models and assessment methods. Furthermore, EVALTOOL environment generates the information about assessments in a consistent and simple way, including graphics showing a summary with the assessment results and it also helps users to use them.

The rest of the paper is structured as follows. In Section Two the State of the Art in software process and tools is analysed. Section Three presents the EVALTOOL environment and describes its main components. In Section Four, the use of the environment is illustrated by means of some examples. Finally, Section Five contains the conclusions and future work.

2 STATE OF THE ART

Several process models and assessment models have been created (See Figure 1) in recent times. Several tools to apply them have also been developed. In this Section we summarize the most outstanding models, and analyze the most widely-used tools.

The Software Engineering Institute of Carnegie Mellon University has developed the *Capability Maturity Model Integrated* (CMMI) (SEI, 2004). This model is based on CMM (Capability Maturity Model) and contains the best practices, grouped in several processes. This process model defines six maturity levels, which classify organizations in a range from chaotic level to continuous improvement level and it can be used in staged or continuous representations.

CMMI uses the *Software CMMI Appraisal Method for Process Improvement* (SCAMPI) (SEI, 2001). This method includes the best assessment practices and defines three steps to plan and prepare the assessment, carry it out, and inform of its results.

The International Organization for Standardization has defined both a process and an assessment method: ISO 12207 (ISO, 2004a) is a life cycle process model that defines the main activities that must be performed during the software development. It groups these activities into processes and categorizes the processes. This norm specifies the life cycle process architecture but not how to implement it. ISO 15504 (ISO, 2004b, 2004c, 2004d) is the standard for carrying out assessments. The last version is divided into five parts and it defines the minimum requirements to guarantee that the assessment results obtained are repeatable and consistent. It defines six capability levels.

There are, moreover, other models oriented to Small and Medium Enterprises (SMEs). MoProSoft (Oktaba et al., 2005) is the process model for Mexican SMEs. It contains nine processes, grouped into three categories, along with EvalProSoft (Oktaba et al., 2004), which is its assessment method. It defines six capability levels, like ISO 15504. The COMPETISOFT project (Oktaba et al., 2007) defines a process model, an assessment

method and an improvement model. These models are designed to be used by SMEs. Its process model defines ten processes, grouped into three categories as an organization hierarchy. The Assessment method defines six capability levels.

On the other hand, several tools have been developed to help in the assessing of processes. The most outstanding ones are based on CMM, CMMI and ISO 15504.

CMM-Quest[1] allows us to evaluate the most important processes of an organization, to determine strengths and weaknesses. It assigns values to objectives, but it can not assess process practices.

Appraisal Wizard[2] is based on SCAMPI, using CMMI as process model. It offers support for assigning values to the elements of the process (practices, objectives, etc). It allows the re-use of the results of an assessment in another later one. There is a light version of this tool called Appraisal Lite[3].

Spice 1-2-1[4] assigns values to base and generic practices. SPiCE Lite[5] offers a quick and efficient way to detect weaknesses and strengths of the process. It shows results as reports or via web and it has two running modes.

Appraisal Assistant Beta[6] offers support for evaluating the maturity of an organization by the creation of user defined models, converting results from one framework to another, and generating reports about each assessment. Appraisal Assistant is now in a Beta version.

In literature we can find other assessment tools, even tools based on spreadsheets. Their functionality is similar to that of the above tools. The main drawback of these tools in comparison to the present work is that each one of these tools uses a specific process model and a specific assessment method (to see Table 1). In the context of the present work our objective is to provide companies with a flexible tool so they can assess their software processes by using different reference models and assessment methods but by using a single environment which facilitates comparison of results. Another important characteristic is that an important development effort has focused on the user interaction facility, by creating a usable GUI.

3 EVALTOOL

A Flexible Environment for the capability assessment of Software Processes has been developed; it is called EVALTOOL. This environment has the following characteristics:

- It allows assessment using different assessment methods (ISO/IEC 15504, SCAMPI, EvalProSoft).
- It is flexible: it allows the defining and addition of new processes by Process Reference Models and new assessment methods, when the methods and processes are compatible with the environment core.
- It allows comparisons between the results of several assessments.
- It stores the models in their repository.
- Its reports show information in diagram form.
- It has a very usable interface, by means of enriched interfaces.

Table 1: Process models and assessment methods used by assessment tools.

Tool	Reference Model	Assessment Method
CMM-Quest	CMMI-SE/SW continuous	ISO/IEC 15504
Appraisal Wizard Appraisal Lite	CMM, CMMI-SE/SW staged and continuous	SCAMPI
SPiCE 1-2-1 SPiCE Lite	ISO/IEC 15504	ISO/IEC 15504:1998
Appraisal Assistant Beta	CMMI	ISO/IEC 15504, SCAMPI
EVALTOOL	Any	Any

To support the assessments using several assessment methods and several process reference models, we have defined a generic metamodel (Figure 2). In this, the elements defined in outstanding process reference models such as ISO 12207, CMMI, COMPETISOFT and respective assessment methods (ISO 15504, SCAMPI, EvalProSoft), have been taken into account. The environment uses this metamodel to guide the assessments. Because of this, the environment is flexible; that is, the environment is able to assess any processes (from a process reference model) that are defined in accord with this metamodel. That being so, the new process included in the environment must be based on conformance of the process reference model with the metamodel defined in the core of the environment. In addition, some modules can be designed to implement the other assessment methods.

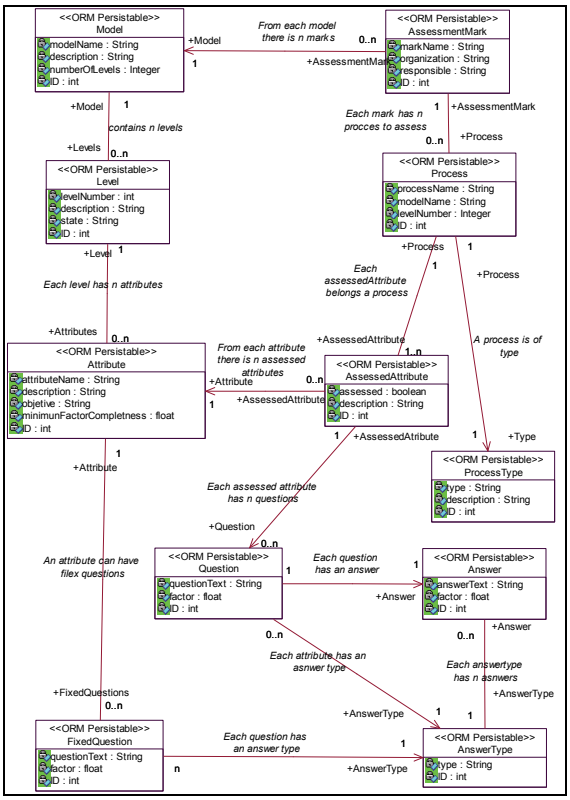

Figure 2: Generic metamodel of process assessment used by EVALTOOL.

The environment is prepared to generate and store the results of each assessment in the same way. So it is possible to retrieve these data and compare them with the results of later assessments. In this way it is easy to see the improvement executed in each process of the organization quickly, by means of the comparison of the results of the process assessment. These results are shown using diagrams, to make them more understandable. Another feature is that its interface has been produced using enriched interfaces, so it is very easy and usable.

The environment is composed of two parts. The first one manages the process reference models and the second one applies the assessment methods over these processes. Figure 3 shows the relationship between both parts which are described below. Both components are linked by the database, which is used by first one to write the new schemas. These schemas are used by the evaluation component to obtain information about the organization that is assessed and its processes.

3.1 Process Model Management

This component (left side of Figure 3) manages the process reference models on which the assessments are conducted. This component supports the inclusion of flexibility in the environment processes related to different process reference models. This part allows the management of models, metamodels and schemas, by applying QVT transformations. It is able to generate the schema associated with each model, to allow the information of each process to be stored in a way that is compatible with the environment. The elements of the process (among others purpose, activities, roles and work products) stored are used to assess that process.

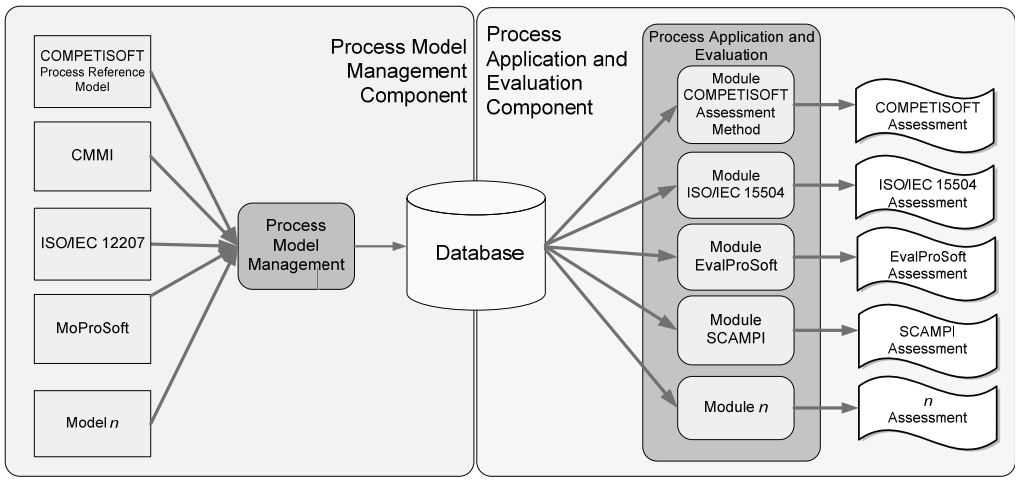

Figure 3: Components of the environment EVALTOOL.

Figure 4: Model application and evaluation part of EVALTOOL interface for SCAMPI and ISO/IEC 15504 assessments.

This part also defines the inverse transformation, from schema to the associated metamodel. The two transformations can be carried out using both run modes, automatically, where models or schemas are transformed without asking the user. They can also be customisable, in which the user contributes with the semantic information to achieve idempotent transformations between models and schemas.

This part is also able to generate a XMI file with the information stored in the base. To do this, the metamodel associated with the schema is obtained and used to create the XMI:SCHEMA.

The interface of the process model management application is a desktop application and it is a very simple one. It offers help to the user and is available in English and Spanish. A more detailed description of this component can be found in (Martínez-Ruiz, García, & Piattini, 2008).

3.2 Model Application and Evaluation

This component allows the definition and assessment of software process, using the databases created by the component described previously. It has been developed using the most advanced technologies. Because of this, it has a very simple, intuitive and easy GUI that helps users to manage the different tool functionalities (Figure 4).

It has the functionality of defining new assessment marks based on existing reference models, already included in the database. An assessment mark includes processes to be assessed and their evaluations. From this it is possible to add processes specific to an organization in order to evaluate them, with reference to one of the schemas defined as well as in accord with the metamodel used by the environment.

This evaluation part is further able to assess the chosen processes by means of answering several questions. The questions are defined from the process reference model stored in the database. An additional feature is that, due to the fact that the results of each assessment are stored in a common way, a comparison between them is possible. We can thereby obtain both the weaknesses and the strengths of processes (and organization). From these we know the points in which an improvement effort needs to be carried out. These are called *improvement opportunities*.

From the main menu (left side of Figure 4) we can create and assess several marks. It is also possible to watch a demonstration of the application.

This application of the environment has two versions; one of them is designed for PC, designed as a web page and offers all the functionality of these. The other one is designed to run in a Pocket PC and offers a subset of this functionality. This version is only able to answer the assessment questions about the process, in a dynamic way and within the scene where the software is developed and the processes take place. It allows us to do quick- assessment so the improvement opportunities can be known very rapidly.

4 EVALTOOL APPLICATION EXAMPLE

EVALTOOL gives support to the process diagnosis activity of an improvement model. This environment has been designed to carry out software process assessments easily. In Figure 5 we can see how the environment is related to the process reference models, the process assessment methods and the process improvement models. The aim of all this is to perform assessments of company process, whose results can be used to begin a process improvement cycle.

Prior to assessment in the context of a software organization, some steps are necessary. First of all, the goals and benefits of the software process assessment must be presented to the organization work forces. Leaders must be in agreement with the assessment and the employees involved must receive the qualification about the models defined in the environment before they use it.

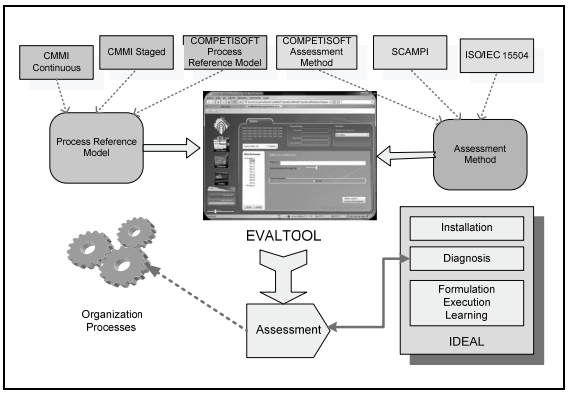

Figure 5: Assessment program with EVALTOOL.

To do an assessment of a previously defined mark using EVALTOOL, it is only necessary to select an Evaluate Mark, and to choose the mark. Then the process can be assessed, by selecting and answering some questions about it. Questions are ordered by processes and their attributes. Once the questions are answered, you can see the assessment report generated (Figure 6). The user is also informed about the process whose capability level is too low.

Figure 6: EVALTOOL assessment results.

The environment stores the results obtained in each assessment and this information is very useful in seeing the progress between two assessments of the same improvement cycle. Figure 7 shows a comparative chart of the results of two assessments carried out in the same improvement cycle.

If the mark is not defined, we can define it by using the Create Mark. The processes of this mark must be in line with the process reference models included in the environment. By means of adding a mark, a new mark is created, and we can include the processes of a given organization (Figure 8) within it. It is, moreover, possible to add some questions to the process attributes of each process.

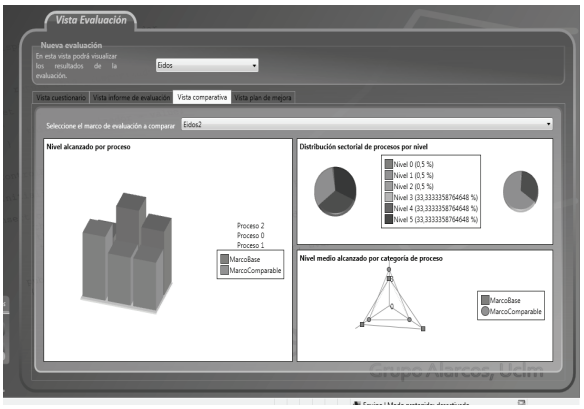

Figure 7: EVALTOOL assessment result comparative.

If the processes of the new mark are not in accord with the process reference models included in the environment, this process reference model has to be defined in the environment. By means of the desktop process model management application, a compatible schema is created in the database, thereby storing all the information about each of the processes of this new process model as well as their sub-elements.

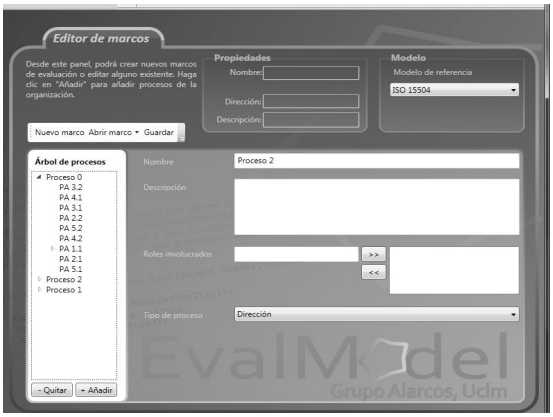

Figure 8: EVALTOOL adding process questionnaire.

5 CONCLUSIONS AND FUTURE WORK

The assessment of software processes is used by software development organizations as a means of knowing the capability level of processes and of improving them. To make the task of assessing the organization processes easier, a flexible environment for the assessment of the capability of software processes has been developed. It is called EVALTOOL.

The environment is designed in such a way as to be used to evaluate a software process by employing any assessment process. This flexibility allows organizations that have a lot of different projects and different processes to use a single tool to evaluate them. In addition, the environment offers the possibility of comparing two capability levels.

Furthermore, the evaluation of software processes gives the work forces of the organization the following positive features:

- Most of the questions presented in the questionnaires help users to have better knowledge of the changes that are being carried out, as well as the activities that would be performed and the difficulties entailed in them.
- The recommendations which the tool gives on the activities that are not carried out help them to provide feedback about their process improvement.
- The environment gives the improvement-manager a viewpoint from which to oversee the process assessed, over a period of time.

The environment is being used to carry out assessments based on the COMPETISOFT Assessment Method. Several Iberoamerican organizations are using them to assess and improve their processes.

Our future work is to extend this environment by adding mechanisms to help users to improve their processes. Based on the results of the assessments, it is possible to determine the strengths and weaknesses of each process. That it turns makes it possible to establish what action is needed for the improvement of the process.

The environment is currently designed to run with a SQL Server database. Other future work can be to adapt it to run with other data sources, such as ODBC, or XML files.

We might also point out that the environment can be adapted to be used as a didactic tool. It can offer support for teaching users how to perform an assessment using any of the assessment methods and any process model.

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