A SYSTEM ON WEB-BASED CONTINUOUS SOFTWARE PROCESS ASSESSMENT (CONTINUOUS SPA)

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Abstract: Software process assessments are now recognized as important quality improvement activities in the software industry. However, most assessment applications are generally regarded as infrequent, expensive and disruptive for the workplace. Hence, it is advantageous to find alternative ways to the current status of software processes and monitor the implementation of improvement activities. In this paper, we focus on continuous process assessment and capability monitoring. A web-based prototype system is developed to perform a practical study on continuous software process assessment in one process area: project management. The study results show that features such as global management, well-defined responsibility and visualization may help improve the efficiency and continuity of software process management.

1 BACKGROUND

Since the 1990's the software process community has been growing in response to the increasing importance of software in industry (Humphrey 1999). Many different standards have been created to help control software quality and production. Up to 2005, the software process assessment (SPA) approaches, such as CMMI (CMMI, 2000; 2002), ISO 15504 (ISO/IEC, 1998; 2003) (also know as SPICE), BOOTSTRAP (Kuvaja et al., 1994; 1999), etc., achieved more than others (Rout, 2003). Although assessments are useful, they are also regarded as expensive and disruptive to the actual software development work and often provide little operational guidance to an improvement programme.

The Deming Cycle (Deming, 1986) shows that selecting a well-defined approach can be a good start to guide the software process improvement effort. Based on the cycle, we are able to find alternative ways to assess software processes continuously and monitor the implementation of improvement activities.

In this paper, we report on the development a tool and an associated study of continuous software process assessment. The paper is organized as follows: section 2 reviews the related work on PROFES; section 3 defines the study outline and the web-based system that implements our study; section 4 describes an example project that uses the system to help with the project management assessment and section 5 summarizes the advantages and drawbacks within the example. The final section gives short conclusions and prospects for future work.

2 RELATED WORK

In 2000, the European project PROFES (Birk et al., 1998) (PROduct-Focused improvement of Embedded Software process) integrated process assessment and the goal-driven software measurement (GQM) (Basili et al. 1994) to enable continuous assessment. The regular steps In PROFES to apply continuous assessment can be summarized as follows (Jävinen and Solingen, 1999) (Jävinen, 2000):

1. Select processes based on standard process areas (e.g. those defined in ISO-15504);
2. Define indicators for process existence dimension and capability dimension;
3. Construct or update GQM and measurement plans;

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4. Collect data and analyze results. Software tools are used for managing the measurement data and producing graphs for analysis sessions.

Experiences in PROFES show that the benefits of continuous assessment include (Jävinen et al. 1999):

- Improved visibility of software processes;
- Early detection of process deviations;
- Reduced cost of assessment.

3 WEB-BASED CONTINUOUS PROCESS ASSESSMENT (CONTINUOUS SPA)

3.1 Motivation

As indicated in ISO 15504(SPICE) (ISO/IEC, 1998; 2003), the main idea of the continuous assessment is to provide an assessment tool that supports collection of data (metrics) in the assessment of process capability.

We are focusing on integrating the following features into assessment instrument:

- Distributed Management: the accessibility of the system should be distributed;
- Well-defined responsibility: user, role and permission management should be well-defined and organized in the system;
- Visualization: the high-level graphs and visualized indicators should be used to help the project participants.

3.2 Purpose

According to the instructive practice of PROFES, it is practical to follow the software process improvement cycle and define the continuous process assessment into step-by-step activities. Our study proceeded by the following steps:

1. Select processes based on ISO-15504 process areas (in the study outlined in this paper, we focus on the Project Management process area).
2. Define products in the selected processes.
3. Construct the measurement plans by determining key process metrics related to the products defined in step 2.
4. Collect and analyze data. Software tools are used to assist in managing and analyzing the collected data.

We developed a prototype system (Continuous SPA) as the tool to perform these four steps.

3.3 System Architecture

Figure 1 shows the system architecture. The web server is the main component of the application, which consists of Servlet, JSP and a set of JAVA classes (some commonly used components might also be included in this part). The main Servlet/JSP component is made up of three subcomponents: Project Management, User/Role Management, and Quality Management. The web server interacts with the Database, processes the data, and creates the web pages for the Web Client.

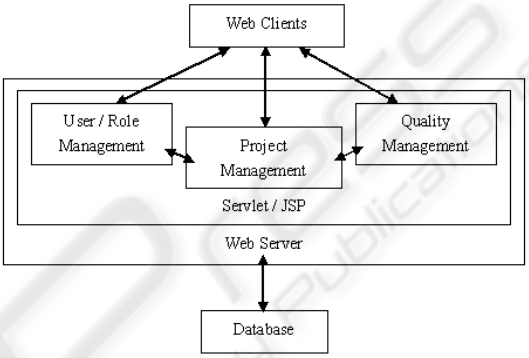

Figure 1: Overview of the System Architecture.

3.4 System Functionalities

Continuous SPA has the following functionalities that help instrument the process assessment:

- construct and manage the work products in project management;
- manage the quality measurements during the product quality life-cycle;
- manage basic information in a project like document management, role management, user & team management, etc;
- integrate the rating function like the SPICE tool or other assessment tools, and provide the indicators for the quality and capability level of the project management.

4 CASE STUDY: ASSESSING PEOPLESOFT ASSET MANAGEMENT

We use the PeopleSoft Asset Management project as an example to show how to apply Continuous SPA in assessing and monitoring the project management. The project is contracted between Administrative Information Systems (AIS) of University of Alberta

and a contracted developer (whose name we are not allowed to specify here, abbr. CD in this paper).

The project's goal is to implement the PeopleSoft Asset Management module within the Financial Services department to manage their building assets, and we use the first phase of the project for our case study. The study proceeded by three steps to map the project properly into Continuous SPA:

1. Define the workflow of the project products;
2. Define the roles for project management;
3. Map the metrics to the project products.

4.1 Define the Workflow of the Project Products

According to the general AIS Methodology Overview (University of Alberta, 2005), the elements in a deliverable workflow can be summarized as Project Charter and Statement of Work (abbr. SOW) followed by a list of deliverables. The following rules are applied to map the project to the deliverable workflow:

- Use blocks to represent the deliverables and milestones.
- Use arrows to represent the dependencies and timelines of the deliverables;
- Use parallel arrows to represent the deliverables proceeded simultaneously.

4.2 Define the Roles and Permissions for Project Participants

In Asset Management, project deliverables are tangible items that CD delivers to the University for their review and approval.

The detailed descriptions and responsibilities of the participants are given in SOW. A participant is categorized into one of the two role groups: CD groups and University groups. Each group has a set of roles.

We defined these roles in Continuous SPA, then granted the permissions (so far three types of permissions: review, modify and rate) for the deliverables defined in step 1 to these roles according to SOW.

4.3 Map the Metrics to the Project Products

We can define metrics according the AIS Project Charter (University of Alberta, 2005) and relate the metrics to deliverables as follows:

1. Select the subset of the measures from the reference model;
2. Define and assign the measures to the related products;
3. Update the values of the measures during the project management.

In the study, we chose those service measures that are easy to handle and defined the corresponding metrics in the system. Then we defined the expected values of the metrics. The service standard level can be put into the metrics description for helping assessors to give the correct values during the rating. In general, a percentage rating system can be used as the standard indicator values. Once the metrics characteristics are defined, the process monitoring can begin. Figure 2 shows a rating scenario for SOW.

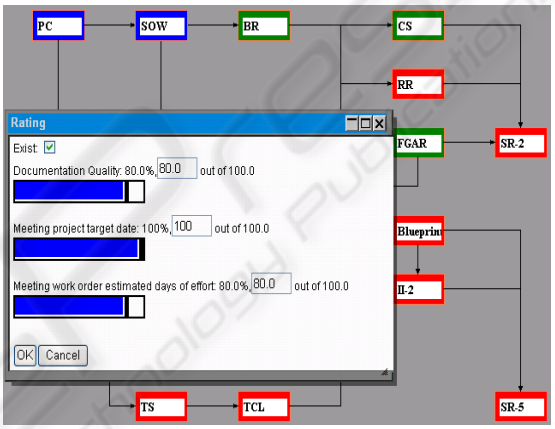

Figure 2: Project Map with Rating Report of SOW (Colorized Sheet).

5 DISCUSSION

In the step-by-step study just outlined above, we described the way Continuous SPA can be used to manage, assess and monitor an ongoing project. The example gave us positive appraisal on mapping local, manual and periodical management process into a global, automatic and continuous process. The following useful features are helping us improve and rethink our software process management approach:

- **Globalization.** The use of web-based application allows process improvement to be global, collaborative and shared.
- **Security.** By using the user/role/permission subsystem, the tension between security and globalization can be largely eliminated in our system.
- **Using Metrics.** The use of metrics assists in the development of a well-defined communication channel between project requirement and project assessment.

- **Visualization.** The system supports the visualization of the product workflows as well as quality measurement.
- **Reusability.** Each module in Continuous SPA is responsible for one or more distinct aspects. These modules were purposely developed into independent components for further change or reuse.

We came across some limitations in using Continuous SPA. The three types of permissions were not sufficient to define and manage all types of responsibilities. We were also unable to map the AIS project change control procedure because its application cannot be predefined for a specific work product. The prototype system needs to be enhanced to model this dynamic behaviour.

6 CONCLUSION AND FUTURE WORK

This paper defines and provides an initial evaluation of a continuous software process assessment prototype system that fills a gap between staged process measurement and continuous process improvement. Our approach integrated modules with the following advantages:

- Web-based management that allows the participants global access to and analysis of up-to-date data;
- Well-defined responsibility for a participant based on a user/role/permission management system;
- Visualized indicators that represent measurement results instantly and allow the user easily identify process improvement opportunities.

The case study shows promising results that improve the efficiency and continuity of software process management.

Our future work is to gather more experiences by using the approach in new projects. We also want to apply some of the important concepts and lessons learned in this project to an examination of service level agreement (SLA) tracking in systems built using Web services and Service Oriented Architecture (SOA).

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