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International Workshop on Models and Processes for the Evaluation of COTS Components (MPEC'04)

Challenges Setting a Process to Manage COTS Component Selection*

Alejandra Cechich
Universidad Nacional del Comahue
Neuquén, Argentina
acechich@uncoma.edu.ar

Mario Piattini
Universidad de Castilla-La Mancha
Ciudad Real, Spain
mario.piattini@uclm.es

Abstract

In attempting to build a COTS integrated system, we can use several methods that typically pay attention to specify search criteria and goals to be met. Yet these methods often overlook some elements in the process such as fact-based decisions and teamwork, which might drive the process helping to increase the probability of success. In this position paper, we identify some features that we have found useful in our research, and which we believe need further discussion before setting a process for COTS component measurement and selection.

1. Introduction

One of the objectives of our work is to enable composers to use some COTS component's aspects as inputs to compute functional suitability and functional adaptation measures, which can be used to measure the impact of integration of COTS components on a stable system [1,2].

Of course, this objective is not unique to our work. It could, in fact, be considered a goal composed of several sub-goals related to software engineering issues. For example, in the realm of software requirements engineering, COTS-Requirements Engineering implies dealing with the use of third-party COTS components, whose services are balanced against system's requirements [3]. In that way, developing software becomes a matter of balancing required and offered functionality among the parties. But required functionality is highly dependent on component's users, i.e. stakeholders of a COTS selection process. Inputs to this process should include discussions with composers, reuse architects, business process coordinators, and so forth. Therefore, stakeholder's preferences should be balanced before starting a selection procedure, so committed requirements are used to determine the degree in which a COTS candidate satisfies the required functionality [4].

However, an aspect that needs further discussion is the possibility of establishing a set of main stakeholders or roles for a selection process. Another aspect that needs more attention is the diverse possibilities of documenting the required functionality. In our proposal, we have chosen scenarios because of their wide use on evaluating architectures, however other representations might be more suitable depending on specific constraints of the system.

Our position is that the aspects and measures for functional selection can be combined into a measurement process, using a standard improvement framework – such as a Six Sigma process [5] – that guides and controls the whole activities [6].

The five-phases of the Six Sigma-based COTS component selection process are shown in Figure 1. Deliverables are summarised in the figure to indicate the existence of a documentation suite composed of criteria for selection, and measures that identify suitability with respect to a source system. Tools in the figure refer to well-known tools for quality assessment as well as specific tools and measures for selecting COTS components.

However, elements to be used during the phases need further discussion. The next section remarks some challenges implied by those phases.

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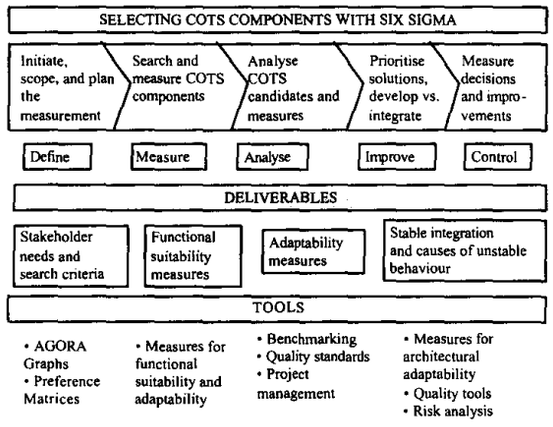

Figure 1: A five-step process

2. Challenges to a Six Sigma-based Process

In a Six Sigma-based process, the "define" phase sets the goals and context of the project. This phase is concerned with identifying key stakeholders, and determining their needs and criteria for selection. To do so, our proposal extends a version of a Goal-Oriented Requirements Analysis Method (AGORA) [7] by considering additional features of COTS components. Particularly, completeness is assumed as a quality factor that represents how many goals in a specification meet stakeholder's needs. Completeness in AGORA is strongly related to contribution values on the path of the adopted goal as well as on its stakeholder's preference value. Particularly, me asures of modifiability and desirability of goals for selection may be derived from AGORA graphs [4].

In COTS component selection, the average stakeholder's preference value of the adopted final goals (*Cup*), might indicate the degree of agreement on stakeholder's preferences, i.e. on the *desirability* of the core goals of the abstract specification of a component. Lower results of *Cup* show a need of further discussion on the required functionality of the component *C*; i.e. causes of disagreement should be detected. For example, stakeholders have different goals, even their perceptions of reality vary significantly. Then, scenarios may drive the agreement process and establish partial consistency among existing systems – all systems involved in using the COTS component.

On the other hand, *modifiability* is about the degree in which committed goals can be changed when selecting COTS components. Let's briefly clarify the point: suppose there is a strong agreement on a set of goals (*Cup* = 80%), however the search of COTS candidates offering the functionalities shows that there are no candidates available. In this case, evaluators should have agreed on the degree in which the goals (even categorised as core) can be modified. Then, the modifiability of the goals will help to decide on acquiring COTS components with less functionality than required, adding the functionality by means of an adapter (such as a wrapper), or building the missed functionality from scratch.

The quality metrics for modifiability include how an AND-OR graph is closed to a tree structure. When there are many incoming edges to a goal, the goal contributes to an achievement of many goals. In consequence, these many goals should be under consideration in case of changing the goal.

Component's goals to be achieved are associated to one or more refined goals of the graph. By doing so, agreement among stakeholders might be achieved by calculating the desirability of each group of refined goals. Then, desirability of the groups should be calculated and decisions might be made based on the following cases, where "agreement-threshold" is a suggested value between 0.7 and 0.8 and "core/peripheral" is the type of refined goal:

- Case 1: desirability(refined goal/s) < agreement-threshold $\wedge$ core $\Rightarrow$ Try other scenarios to get agreement
- Case 2: desirability(refined goal/s) < agreement-threshold $\wedge$ peripheral $\Rightarrow$ decision to discharge
- Case 3: desirability(refined goal/s) $\geq$ agreement-threshold $\wedge$ peripheral $\Rightarrow$ decision to retain
- Case 4: desirability(refined goal/s) $\geq$ agreement-threshold $\wedge$ core $\Rightarrow$ keep for the selection process

Modifiability is calculated to be used during the selection procedure, whether decisions on buying or developing should be made. Having higher values on modifiability (around 90%) on a core requirement would indicate that we could potentially resign most of our expectations on this requirement letting offered services prevail. For example, we could keep some of the alternative goals resigning others whether COTS candidates are hard to find or adapt.

Of course, actually classifying the requirements as "core" or "peripheral" is another different concern. We assume that the classification is valid and it remains stable during the selection process. However, not conclusive values (40% to 70%) of modifiability would indicate that there is a good chance of negotiating (and changing) the requirements when balancing between offered services of candidates. But it also could indicate that the classification as "core" should be reviewed.

But setting the right requirements for selection, and identifying domains and functions for comparison are not easy tasks. Different scenarios should guide the process taking into account the different goals that are relevant in each stage. Then, goals are discovered and refined iteratively to reach commitment among all stakeholders involved in the process. For example, the existence of scenarios might be guided by the discovery process at different levels as introduced by C. Rolland et al. [8]. However, expertise and knowledge to define scenarios are here as important as they are in traditional elicitation processes. Besides, goals may also help determine different granularities of COTS components to be selected, which introduce the need of different treatments for evaluation.

The "measuring" phase of a Six Sigma-based process is concerned with assisting the selection process by creating a complete description of the COTS candidates. Our model supposes that there is an architectural definition of a system, whose behaviour has been depicted by scenarios. We express the semantics distance between an abstract specification of a component and its possible instantiations in terms of functional suitability measures, which provide a better identification of the different COTS component functionalities [2].

But collecting effective measures is highly dependent on the amount and quality of the information provided by third parties. Once requirements are categorised and weighted, a process to obtain and assess product and vendor information should be carried out [9]. Standardizing the required information for analysis still remains an open issue.

Finally, during the "analysis" phase of a Six Sigma-based process a COTS candidate or a set of COTS candidates is selected from several alternatives, and decisions are made based on previous definitions and measurements. Basement for decisions might include detecting sub-domains affected by the recently incorporated COTS and identifying dissatisfactions according to the stability state established in the "definition" phase.

Architectural adaptability might define calculations for measures of changes that affect system's stability in architectural terms. Adaptability of an architecture can be traced back to the requirements of the software system for which the architecture was developed. For example, the POMSAA (Process-Oriented Metrics for Software Architecture Adaptability) framework [10] achieves the need of tracing by adopting the NFR (Non-Functional Requirements) framework.

But determining the impact of a component solution on a given architecture (measured in terms of functional architectural adaptability) is a quite outstanding challenge. We suggest particularly here integrating qualitative and quantitative measures for analysis considering that: (1) qualitative judgments are based on better values to be evaluated; (2) quantitative values provide a more objective scale for comparison among alternatives; and (3) design decisions might be more formally specified.

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Conference announcements

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CALL FOR PARTICIPATION

International Workshop on Models and Processes for the
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an ICSE'04 workshop

May 25, 2004, Edinburgh, Scotland, UK

Up-to-date information on the workshop can be found at

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SCOPE

Commercial Off-The-Shelf (COTS) software components play
an increasingly important role in software systems development.
Successful COTS- based system development requires some
particular activities to be performed, among which we find COTS
evaluation. The workshop will bring together researchers and
practitioners interested in models representing the COTS
evaluation criteria and in the evaluations themselves, as well
as in the process to conduct the evaluation activity.

KEYNOTE SPEAKER

Software's "Inoperable" Interoperability Problem
Jeffrey Voas (Cigital Incorporated - USA)

WORSHOP FORMAT

The workshop will be organized according to the following:
· A keynote opening speech
· Short presentations of the 12 accepted contributions
· Identification of open issues to discuss
· Interactive discussions
· Wrap-up session
The accepted contributions will be available in the workshop
web site in early May for pre-workshop dissemination.

REGISTRATION

The registration and venue information is at the web site:
http://conferences.iee.org/icse2004/Welcome.html
Please note that attendance is not restricted to paper presenters
but open to the community.

For more information:
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Commercial Off-The-Shelf (COTS) software components (hereafter, COTS) play an
increasingly important role in software systems development. Successful COTS-
based system development requires some particular activities to be performed,
among which we find COTS evaluation. This activity is one of the cornerstones
of COTS selection, COTS implementation and cost models for COTS. Its importance
and also its complexity are growing more and more due to the increasing number
of COTS domains and products available. It results that models for