

Maurizio Morisio (Ed.)

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Reuse of Off-the-Shelf Components

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Preface

Software reuse as an umbrella concept has been around for several decades. Over time, new techniques and approaches have been proposed to implement the concept, from libraries of reusable assets to product lines, to generative methods.

These latter techniques are mostly used in intra-organizational reuse, and require considerable formal knowledge over the evolution of technology and required functionality in a domain over several years.

On the other end of the spectrum, extra-organizational reuse is based on reuse of off-the-shelf (OTS) software (both open and closed source, acquired for free or for a fee). Here, a limited investment and immediate availability of the assets have widely spread the approach. On the other hand, the reusing organization has no control on the evolution of the functionality and assumptions of the asset. Even when the assets are open source, they are seldom modified.

The theme for this ninth meeting is the reuse of off-the-shelf (OTS) components and related problems:

- * Documentation of OTS components
- * Processes to identify and select OTS components
- * Integration and evolution problems
- * Reliability and security of OTS components and legal issues
- * Interaction with the developer community or with the vendor

The proceedings you are holding cover these issues as well as development and use of product lines, variability modeling, aspect-based development, composition of components and services.

June 2006

Maurizio Morisio

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A Goal-Oriented Strategy for Supporting Commercial Off-the-Shelf Components Selection

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Abstract. The use of Commercial Off-The-Shelf (COTS) components is becoming a strategic need because they offer the possibility to build systems at reduced costs and within shorter development time. Having efficient and reliable COTS components selection methods is a key issue not only for exploiting the potential benefits of this technology, but also for facing the problems and risks involved. Searching COTS components requires to overcome several obstacles: the growing size and evolvability of the COTS marketplace, the dependencies from the components to be selected with others, and the type of descriptions currently available for those components. In this paper, we present a goal-oriented strategy for an effective localization, analysis and structuring of COTS components information. Our proposal is the GOThIC method, which provides methodological support to the construction of taxonomies. We present the seven activities that conform this method, which are illustrated with the case of real-time synchronous communication tools.

1 Introduction

Nowadays, the construction of systems based on pre-packaged solutions, usually known as Off-The-Shelf (OTS) components, is becoming an economic and strategic need in a wide variety of different application areas. The potential benefits of OTS technologies are mainly the reduced cost and shorter development time, while maintaining the quality [1]. Nevertheless, many challenges, ranging from technical to legal must be faced for adapting the traditional software engineering activities with the aim of exploiting these benefits.

One of the most critical activities in OTS-based systems development is the selection of the components that must be integrated therein. Selection is basically composed of two main activities, namely search of candidates and their evaluation with respect to system requirements.

However, most of the different existing methods for COTS selection -as those surveyed in [2] and [3]- (e.g. CAP, CARE, CEP, CRE, OTSO, PECA, PORE, QESTA, Scarlet, STACE, and Storyboard) focus on evaluation instead of search. This lack of specific proposals is a serious drawback that impacts in selection reliability: no matter how good is the evaluation process, selection may be wrong if the candidates chosen to be evaluated are not the right ones.

Searching candidate OTS components is not an easy task, especially in the case of Commercial-Off-The-Shelf (COTS) components, i.e. components that are acquired for a fee. On the one hand, COTS components are a class of reusable components, and it is well-known that one of the essential problems in reusing software components is locating and retrieving them from a large collection [4]. On the other hand, COTS search must cope with some challenging characteristics:

1. *Growing size of the COTS marketplace*: New and improved products and technologies are continuously offered. Thus, existing market segments offer more and more products, and new market segments are continuously emerging. Mobile technologies are a good example of both situations.
2. *Rapid changes in the COTS marketplace*: New versions of existing products are released every few months. Moreover, market segments frontiers move slightly over the years, making products to offer services that initially were seen as belonging to different segments. For instance, current mail server systems usually provide instant messaging facilities, even video-conferencing services.
3. *Dependencies among COTS components*: COTS components are not designed to work isolated, but in collaboration with others. Therefore many dependencies among them exist, either for enabling, enhancing or complementing their functionality [5]. For instance, document management systems need document imaging tools for scanning and storing paper documents.
4. *Type of descriptions available for COTS components*: COTS components suppliers do not provide the kind of structured information that would allow performing automated or at least assisted search. Moreover, it is not realistic to think that the situation will change in the future. This is especially true for coarse-grained COTS components such as ERP, CRM or CMS systems. The situation is aggravated by the fact that supplier information of course tends to highlight strengths and hide weaknesses of the licensed components.

Consequently, when carrying out a particular searching process, some practical questions may arise: Which are the market segments of interest for this particular context? Which are the relationships among the identified market segments and which are their implied needs? How can structured and trustable information be obtained for the COTS components available in the marketplace?

In this paper, we claim that an effective COTS search strategy shall rely on a thorough description of the COTS marketplace whose nature adapts to the above mentioned characteristics (diversity, size, evolvability, interoperability, lack of structure and subjectivity) and therefore provides real answers to the questions above. Therefore, we present a method called GOTHIC (Goal-Oriented Taxonomy and reuse Infrastructure Construction) aimed at building a reuse infrastructure that may be used in COTS search processes by arranging marketplace segments as a taxonomy. The nodes of this taxonomy are characterized by means of goals and their relationships declared as dependencies. The method includes a domain analysis phase which faces the problem of unstructured and not validated information coming from lots of information sources. The rest of the paper is organized as follows. In section 2 we present our research method and previous work. Related work is presented in section 3. The core of the proposal, the GOTHIC method, is presented from sections 4 to 11,

illustrated with a case study on the category of real-time synchronous communication tools. Finally, in section 12 we give the conclusions and some future work.

2 Research Method and Previous Work

Our proposal relies on several industrial experiences which have been undertaken under action-research premises [6], as well as literature survey and grounded theory [7]. Furthermore, we have formulated in early work some preliminary proposals. This section provides details about both points.

The first industrial experience taken was in the context of an academic record management information system development which was planned to include some strategic business functionalities. We undertook a thorough analysis of the domain and experimented the problems mentioned in the introduction. As a result, we presented a first paper [8] proposing the use of taxonomies to structure the COTS business application marketplace. After this, we had other collaborations in the field of requirements management tools, telephony systems and others. We complemented these real cases with some academic ones. As a result, given that there is some evidence that goals are quite stable with respect to changes [9] and goal refinement provides a natural mechanism for structuring and exploring many alternatives [10], we incorporated the notion of goal to formalize the meaning of the nodes in the taxonomy making it domain-independent. Subsequently, we presented a goal-oriented method called GBTCM (*Goal-Based Taxonomy Construction Method*) which added the process dimension to our previous work [11]. It was inspired on GBRAM (*Goal-Based Requirements Analysis Method*) [10], a widespread method in the requirements engineering discipline. Although GBTCM was an improvement of our previous work, we have recently encountered some method design flaws, some due to the use of GBRAM in a different context, others due to our method as such. The flaws are:

- GBRAM is a requirements acquisition method; therefore the sources of information are mainly human beings, which is not the case in the COTS context.
- Furthermore, GBRAM lacks of proper mechanisms to deal with the huge amount of unstructured information of the COTS marketplace.
- GBTCM does not give the required importance to the analysis of the domain, which is more difficult than in a non-COTS context because expertise is needed not only on the domain itself but also on how this domain is represented in the marketplace.
- GBRAM is a one-shot method, with no orientation to knowledge reuse.
- GBTCM focuses on the market segments but did not consider the COTS components themselves.
- GBTCM definition was not oriented to having tool-support.

The GOTHIC method presented in this paper, aims at overcoming these flaws.

3 Related Work

Due to the highly applicable nature of the subject of our research, we find related work not only concerning scientific proposals but also in the way that the COTS