Mecanos as Basis of a Compositional/Generative Mixed Reuse Model

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Abstract

Systematic reuse activities should take place to avoid the ad hoc reuse approaches. In this way, it's important to consider two key elements: a reusable software element with a variable granularity, which should simultaneously supports multiple levels of abstraction, and a reuse model built around it.

This paper presents a reuse model where composition and generation technologies work together to construct multilevel reusable software elements called Mecanos.

Keywords

Reuse model, Mecano, product line, composition technology and generation technology.

1. Introduction

The reusable element definition is an important issue in the introduction of software reuse into an organization. The reuse approach as well as classification, storage and retrieval activities are closely related to the definition of the reuse structure.

Different kinds of reuse elements may be found in the specialized literature. Most of them are based on fine grain structures that belong to an abstract level. Nevertheless there are approaches based on coarse grain structures which promote products and/or reuse models. Reuse structures supporting these kinds of reuse include constituents from different abstraction levels. The **EEC-SPRIT II ITHACA** project [1] – *It defines a complex reusable element called Application Frame* - and the **CARDS Library Model** [7] – *where a reuse paradigm based on the idea "components in, systems out" is presented* – are the two main references of the coarse grain approach.

In this way, a reusable software element has been defined by our group (the GIRO[1] group), called Mecano, with a variable granularity and multiple abstraction levels support [3, 4]. The Mecano structure definition is one of the main tasks in the research CICYT-TIC97-0593-C05-05 Project [2], concerning systematic reuse.

The experiences acquired in the Mecano definition and the lessons learned by applying the Mecano structure into the image processing [6] and university educational management domains are leading us to the creation of a reuse model based on Mecanos as reusable software elements.

The remainder of the paper is organized as follows. In section two a brief Mecano presentation is made. In the third section we present our position about our reuse model approach. Section four closes the paper with a short summary and some future work.

2. Mecano: A Course Grain Reusable Software Element

Mecano, as complex reuse structure, should define a course grain reusable software element, which:

- Increases the abstraction level of the reuse process.
- Supports many different levels of abstraction simultaneously.
- Supports traceability.

A Mecano is a set of interrelated assets. Every reuse domain space is supposed to be classified in three abstraction levels (requirements, design and implementation). Therefore, each asset is classified in one, and only in one, abstraction level. Due to the different abstraction levels supported by the Mecano, there are two kinds of relationship between assets: the intralevel relationships – among assets classified in the same abstraction level – and the interlevel relationships – among assets classified in different abstraction levels.

For a coarse grain reusable software element being considered as Mecano, it has to fulfil the following constraint: "*At least an interlevel relationship must exists in every Mecano*".

The practical implementation of this reuse element has been achived in two steps. Firstly, the EUROWARE Repository [10] was adapted to support the Mecano structure. The second step was directed to populate the repository with Mecanos in the image-processing domain, for this propose a reengineering work was done to identify the assets in the studied domain, and then Mecanos have been constructed with a compositional approach and they have been stored in the adapted repository [6].

The lessons learned in the image-processing Mecanos definition persuade us to use a product-line reuse approach supported by the Mecano notion. In this way, a new reuse project is in its first steps. The main goal of this project is the implantation of a

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[1] Grupo de Investigación en Reutilización y Orientación al Objeto (Object-Oriented and Reuse Research Group).

[2] This project is part of the MENHIR Project. The MENHIR Project is a co-operative project between five Spanish Universities (Granada, Murcia, Sevilla, Valencia y Valladolid) that's financed by the CICYT (The Spanish Agency for Science and Technology).

university-buildings management product line in the university educational management domain.

The experiences and lessons learned in both theoretical and practical work are reflected in the GIRO Reuse Model (GRM) whose main directives are presented in the next section.

3. Position: The GIRO Reuse Model

A reuse model is a mature symptom for an organization reuse policy. The reuse model is the responsible of the characterisation for all reuse situations derived from the creation, organization and evaluation of the reusable software elements that belong to the organization. We can cite some representative examples of reuse models in the literature [8, 2, 9].

The GRM has its basis in Mecanos. It presents three orthogonal views: the technical reuse model, the process reuse model and the quality and metrics for reuse model.

The work made until now has been centred in the technical view of the reuse model. The technical reuse model refers to all the activities related to the management of the Mecanos (creation, storage, classification and retrieve).

The technical reuse model presents a duality compositional/generative in the creation of Mecanos. Firstly, Mecanos can be built as composition of individual assets based on their interrelationships. This operation is a typical development-for-reuse activity, the result of which is a reusable element that can be reused as-is in a development-with-reuse activity. However, when a Mecano doesn't match the reuser' specifications it cannot be reused as-is, consequently a Mecano can be generated by composition of the assets stored in the repository, following the relationships among the assets [5], so the generative approach is a development-with-reuse activity.

The process reuse model covers the logical organization of the personal, resources, methods, procedures and so on into work activities designed to produce a specific end result, a work product.

The quality and metrics for reuse model presents the quality policy of the organization with the evaluation and certification criteria for Mecanos. These criteria should be based on reuse metrics for the products (Mecanos) and the processes.

4. Concluding Remarks and Future Work

The focus of this project is the construction of a reuse model based on a multilevel abstraction reusable software element called Mecano. The proposed reuse model has three different points of view or actuation areas. The work carried out until now has been directed to the definition and testing of the technical reuse model, with a special attention to the mixed compositional/generative constructive process.

The benefits of the reuse model proposed are bigger when the mecanos represent one or more product lines in the same domain.

A lot of work still remains to be done. The process model and the quality model are in the beginning. A bigger integration of the concept of product lines with Mecanos is

required, and the actual and future work in the university educational domain is directed in this way.

5. Acknowledgements

6. References

[1] **Ader, M., Nierstrasz, O., McMahon, S., Muller, G. and Pröfrock, A-K.** "*The ITHACA Technology: A Landscape for Object-Oriented Appliction Development*". In the proceedings of ESPRIT'90 Conference. Kluwer Academic Publisher. November, 1990.

[2] **Edwards, Stephen H.** "*The 3C Model of Reusable Software Components*". In the proceedings of the Third Annual Workshop: Methods and Tools for Reuse. 1990.

[3] **García, F. J., Marqués, J. M. y Maudes, J. M.** "*Mecano: Una Propuesta de Componente Software Reutilizable*". In the proceedings of the II Jornadas de Ingeniería del Software (Donostia-San Sebastián, España, 3-5 septiembre de 1997): 232-244. 1997.

[4] **García, F. J., Marqués, J. M., Laguna, M. Á. y Maudes, J. M.** "*Estructuras Complejas de Reutilización: Definición de Mecano Estático*". In the proceedings of the II Jornadas de Trabajo MENHIR. Editor José A. Carsí (Valencia, 19-20 de Febrero de 1998): 135-141. 1998.

[5] **García, F. J., Marqués, J. M., Laguna, M. Á. y Maudes, J. M.** "*Influencia de las Relaciones entre Elementos Software Reutilizables en la Generación de Mecanos*". Acepted in the III Jornadas de Ingeniería del Software (Murcia, Noviembre de 1998). 1998.

[6] **Martínez Jiménez, Beatriz y Maudes Raedo, Margarita**. "*Desarrollo de Componentes Software Reutilizables para el Dominio del Tratamiento Digital de Imágenes*". Proyecto Fin de Carrera de la Ingeniería Técnica en Informática de Sistemas de la Universidad de Valladolid. Departamento de Informática (ATC, CCIA, y LSI) Escuela Universitaria Politécnica de Valladolid. Dirigido por José Manuel Marqués Corral y Francisco José García Peñalvo. Septiembre, 1997.

[7] **Petracca, Aleisa and Bock, Tom**. "*Command Center Library Model Document Release 4.0 Comprehensive Approach to Reusable Defense Software (CARDS)*". Technical Report STARS-VC-B015/002/00. 31 May 1994.

[8] **Prieto-Díaz, Rubén and Freeman, Peter.** "*Classifying Software for Reusability*". In the Tutorial: Software Reusability, Peter Freeman editor. IEEE Computer Society Press: 106-116. 1987.

[9] **Rine, David C. and Nada, Nader.** "*Software Reuse Manufacturing Reference Model: Development and Validation*". http://www.gmu.edu/depts/survey/rrmpaper1.htm. 1998.

[10] **SER Consortium.** "*Solutions for Software Evolution and Reuse*". SER Esprit Project 9809. January, 1996.