NDT & METRICA V3
An Approach for Public Organizations based on Model Driven Engineering

[1]M. J. Escalona, [1]J. J. Gutiérrez, [1]J. A. Ortega, [1]I. Ramos and [2]G. Aragón
[1]*University of Seville, Spain*

[2]*everis, Spain*

Keywords: Web Engineering, public administrations, Web Requirements, Métrica.

Abstract: In Spain, the Ministry of Public Administrations defined a methodological environment, named Métrica v3, to develop software system in public administrations in Spain. External companies that work for public administrations, internal software departments or software engineer have to follow the life cycle of Métrica for developing their software systems. However, when Web systems are developed, Métrica could be enriched with new approaches from the Web Engineering environment. In this paper, a fusion between Métrica and NDT, a web approach for requirements treatment and analysis, is presented. This fusion is being applying in real projects with very good results.

1 INTRODUCTION

In enterprise environments, the application of software engineering is not yet a common practise. However, everyday more companies and organization apply software approaches in order to develop more quality software.

In Spain, the Ministry of Public Administrations defined a methodological environment named Métrica (www.csi.map.es/csi/metrica3). In this approach, a life cycle and a group of techniques and models are defined in detail. Public organizations in Spain follow Métrica in their internal project, which are developed by themselves, but also they commit their software suppliers to use the methodology.

On the other hand, in the last years, a high number of software projects are developed in the Web environment.

In this paper, a normalization of the requirements treatment of Métrica is proposed. This normalization is based on the fusion of Métrica and NDT (Navigational Development Techniques) (Escalona, 2004). NDT is a Model Driven Web Engineering approach to deal with requirements in web software projects, although it can be also applied in classic projects. The fusion between both techniques offers a suitable reference for Web software development that is being applied in Seville in different real projects.

In order to introduce the fusion and its advantages, in section 2 and 3 Métrica and NDT are described. In section 4, the approach of fusion is analysed and, in section 5, the advantages and the practical experience of this fusion are presented with conclusions and future works.

2 MÉTRICA V3

Métrica is a methodological environment developed by the Spanish Ministry of Public Administration. In the last version of Métrica, V3, the object oriented paradigm was included as an option of developed and Métrica proposes to use UML (OMG, 2003) to model different aspects in the life cycle. The life cycle of Métrica v3 starts with the Information System Planning (PSI) where the organization is studied and the environment for developing and new systems in the organization are defined.

When the PSI defines the necessity of a new system, a viability study must be developed (EVS). EVS is an optional phase but it is mandatory in big and complex developments.

The next phases are mandatory for each system. The first phase, the analysis phase (ASI) must detect system requirements and analyse them in order to define the scope of the system. After the analysis, the design phase must be affronted (DSI). The next phase is the construction of the system (CSI), where the system is translated into the selected programming language. And, finally, the maintenance phase must be applied (MSI). For each phase, Métrica defines tasks and objectives that must be covered.

J. Escalona M., J. Gutiérrez J., A. Ortega J., Ramos I. and Aragón G. (2008).
NDT & METRICA V3 - An Approach for Public Organizations based on Model Driven Engineering.
In *Proceedings of the Fourth International Conference on Web Information Systems and Technologies*, pages 224-227
DOI: 10.5220/0001516602240227

Besides, Métrica offers a technique guide that can be applied in each task.

Métrica is highly applied in Spain, mainly in public administration. However, also private companies use it because they have to follow their public clients' rules. Métrica is a very complex and extensive approach. It offers a wide life cycle with a wide number of techniques and tasks. However, for companies, sometimes it is very complex to identify which parts of Métrica must be used or what products must be generated.

This problem is very relevant in the requirements treatment because, in Métrica, only the use case diagram technique (OMG, 2003) is proposed for this phase. Use cases, mainly in complex environments, are very ambiguous and they must be completed with some description in order to save this ambiguity (Insfran et al., 2002) (Vilain et al., 2002). Besides, they are not enough to extract the necessary information to get analysis models.

3 NDT: NAVIGATIONAL DEVELOPMENT TECHNIQUES

NDT is a model-driven Web methodological process focused on the requirements and the analysis phases. NDT offers a systematic way to deal with the special characteristic of the web environment. NDT is based on the definition of formal metamodels, presented in (Escalona, 2004), that allow to create derivation relations between models. NDT takes this theoretic base and enriches it with the necessary elements to define a methodology: techniques, models, methodological process, etc. in order to offer a suitable context to be applied in real projects.

In this sense, NDT starts with the theoretic definition of the requirements engineering metamodels and it proposes a methodological environment to drive the team in the capture, definition and validation of requirements. With the theoretic base of metamodels and relations, the next phase is the analysis phase. In the analysis phase three models are generated. (1) The conceptual model that defines the static structure of the information and its relations. (2) The navigational model that defines how users can navigate through the information. (3) The abstract interface model is composed by a group of HTML and XML prototypes that let validate the conceptual and navigational models (Olsina, 2002).

However, the generation of these three models is made in two phases. In the first one, analysis models are generated systematically from the requirements using the theoretic relations defined between models. These models are named basic analysis models. In these basic models, the analyst can make some changes in order to make them more suitable, getting the final analysis models.

NDT also normalizes the structure of the results that must be developed during the requirements engineering and the analysis phase because it offers a complete definition of each obtained document.

In conclusion, NDT can be defined as a methodology to the requirements and analysis phases, the rest of the life cycle is dealt with other approaches. NDT is offered to cover a gap in the treatment of the first phases of the life cycle in the Web Engineering (Escalona et al. 2007).

Finally, it is important to stick out that NDT has an associated tool, named NDT-Tool (Escalona 2004) that supports all the life cycle of NDT. This tool lets automate all the systematic processes of NDT, applies all its techniques and gets the results automatically.

4 FUSION OF METRICA V3 & NDT

According to section 2, one of the main gaps of Métrica is that it proposes use cases as the only technique to deal with requirements and in complex and big systems they are too ambiguous. NDT is an approach based on UML that offers a methodological environment to deal with requirements. Métrica v3 offers the possibility of working in the object oriented paradigm or in the structured paradigm. Our fusion is focused in the object oriented paradigm because NDT is completely object oriented.

We propose an extension for ASI phase of Métrica. NDT techniques and model-driven Web engineering are fused to Métrica in order to get a normalization of requirements. Focusing our work in the ASI phase, Métrica proposes 11 activities. Each of these activities will be redefined and enriched by our approach. In figure 1 the ASI structure is presented. Shadowed phases are not necessary for object oriented development.

The fusion can be affronted easily using the power of metamodels. Métrica assumes UML as a modeller language for all its analysis models. UML defines a metamodel for each model proposed in the model language. By other side, NDT is based on a set of metamodel, which are extensions of UML metamodel. Using the power of the heritage, NDT defines the same concepts than UML and some concepts news. In this sense, NDT follows the idea proposes in (Escalona & Koch, 2007), where the power of metamodels are presented to fuse approaches.

The idea of extension is used to enrich Métrica in each activity of ASI in three ways:

1- With new concepts.
2- With new techniques to deal with concepts.
3- With new normalization to represent concepts.

In this section, each activity of ASI is presented in detail and the extension of the fusion is described.

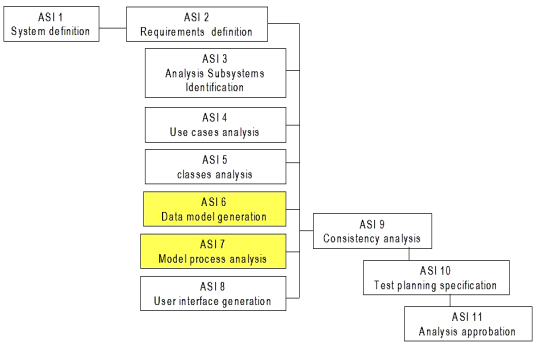

Figure 1: ASI tasks.

- **System Definition**

In this activity, Métrica propose to define the system environment, the development team and the group of standards and rules of the company that must be used. Métrica proposes to use techniques like interviews and use cases to define the system. NDT proposes enriched it with the use of patterns. NDT defines a specific pattern to collect system objectives. Besides, it proposes to use another requirements elicitation techniques like JAD, Brainstorming, Concept Map, Checklist, etc. (Escalona, 2004).

- **Requirements Definition**

In the second activity, Métrica proposes to elicit, define and validate requirements. Techniques proposes by Métrica are interviews, workshops and use cases. NDT increases this activity with specific techniques to elicit requirements, like JAD or Brainstorming and with specific techniques to validate them, like thesaurus, reviews and glossaries. However, the most important contribution of NDT in this activity is to offer a group of patterns to define requirements and enriches use cases. In this activity, Métrica proposes to get the requirements catalogue. NDT offers a template for this document in order to include all the necessities of the system. Even, if NDT-Tool is used, the generation of the requirements catalogue in pdf is an automatic process.

- **Analysis Subsystems Identification**

Analysing requirements, Métrica proposes in the third activity to identify the different subsystems in the system. For the object oriented paradigm, Métrica uses the package diagram of UML for that activity. NDT proposes use the same technique. However, the generation of package in analysis is a systematic task in NDT. Following the requirements definition in patterns and applying model driven engineering, NDT divides the system into two packages: *nature* and *normal classes*. After that, the analyst can make some changes, but NDT controls that these changes are agree with requirements.

- **Use Cases and Classes Analysis**

In activities four and five, Métrica poses to analyse the use cases and to build the class diagram. This step in NDT is automatic from the requirements. NDT offers a systematic way, based on MDE, to extract the requirements information and get the class diagram. If NDT-Tool is used, this step is completely automatic. This class diagram is the basic class diagram. After generating it, the development team can follow NDT heuristics to get the final model.

- **Data Model and Process Model Generation**

Activities six and seven are to generate the data model and the process model. These activities only must be executed in the structured paradigm. Our approach only works in the object oriented paradigm, thus we are not going to deal with these activities.

- **User Interface Generation**

In the eighth activity, Métrica proposes to get the user interface. NDT offers a new orientation for this activity. NDT enriches Métrica and proposes to get two different models in this activity. (1) The *navigational model*, using a class diagram to represent the navigation possibilities of the system. (2) The prototype model, using html to model the future interface of the system without design detail. Both models can be generated from requirements in NDT using metamodels and MDE.

- **Consistency Analysis**

When the analysis is developed and before generating the analysis document, Métrica proposes to study the consistence between requirements and analysis models. If our approach is used, this activity is not necessary. If patterns to describe requirements are used and MDE is applied following the NDT rules, requirements and analysis models are consistent. Relations define between NDT metamodels assure that changes are controlled and they do not provoke inconsistencies in requirements and analysis.

- **Test Planning Specification and Analysis Approbation**

Finally, in activities ten and eleven, Métrica proposes to define the test planning and to validate and approve the analysis results. In this sense, NDT assume the Métrica guides and techniques and it did not add any change.

5 CONCLUSIONS AND FUTURE WORKS

This paper presented a successful fusion between two software approaches: Métrica and NDT. The first one is a general methodological environment to develop software systems in public administration in Spain and, the second one is a MDWE approach to deal with the requirements and the analysis phase.

As it was introduced, Métrica is a very used technique to develop software systems in Spain. Public organization and private companies use it as a reference to develop their system. Everyday, the object oriented version of Métrica is more used and, nowadays, most projects are developed using the OO paradigm in Métrica. However, as we said, Métrica is sometime ambiguous.

With our fusion, Métrica is enriched with:

- The requirements treatment of Métrica is enriched with requirements elicitation techniques, with requirements definition techniques and with requirements validation techniques.
- Model-driven engineering NDT techniques are included in the ASI phase. They allow generating model systematically from the requirements. Even this derivation can be automatic if NDT-Tool is used. This generation reduces the development time.
- The requirements catalogue and the analysis document can be developed automatically with NDT-Tool.
- ASI phase can be affronted using NDT-Tool. The tool guarantees the consistency between requirements and model and reduces the development time, because it produces results automatically.

For these advantages, our fusion was accepted by several companies in Andalusia. The Consejería de Cultura and the Servicio Andaluz de Salud, assumed the fusion of Métrica and NDT presented to developed their projects. Two companies, Telvent and everis, also accepted the approach for their development. Besides, NDT is a technique applied in several real projects. In (Escalona et al., 2006), a general view of these applications can be found.

If we try to analyse why this fusion was possible, the answer is on metamodels. NDT is completely metamodelled as an extension of UML 2.0. The OO version of Métrica proposes to use UML 2.0 as modeller language. Obviously, metamodels of Métrica and metamodels of UML are the same. Thus, basically, our approach is the extension of Métrica metamodels using the extension of NDT.

The facility of fusion based on the fusion of metamodels is an important fact. Model-driven engineering proposes to focus the approach on the definition of metamodels and relations between them, and also derivation rules to generate one model from another. Thus, our practical approach proves this idea and concludes with very good results.

Results in real projects are so good, that we are working in different areas to advance in this kind of approach. First, we are working in the tool, NDT-Tool. It is being revised in order to improve its usability and navigability. Another important actual and future work is to review the next phases of Métrica. For this work, we are focusing in the fusion of metamodels and, after that, we presented a new definition of DSI like the one presented for ASI in section 4.

Obviously, we want to continue working with real projects because it is a very interesting feedback for our works.

ACKNOWLEDGEMENTS

This research has been supported by the project QSimTest (TIN2007-67843-C06_03) and by the RePRIS project of the Ministerio de Educación y Ciencia (TIN2007-30391-E), Spain.

REFERENCES

Escalona, M.J. Modelos y técnicas para la especificación y el análisis de la Navegación en sistemas software. Ph. European Thesis. Department of Computer Languages and Systems. University of Seville. Spain. 2004.

Escalona, M.J., Gutierrez, J.J., Villadiego, D., León, A., Torres, A.H. Practical Experience in Web Engineering. Proceedings of the ISD 2006. Check Republic. 2006.

Escalona, M.J., Torres, J., Mejías, M., Gutierrez, J.J. and Villadiego, D. The Treatment of Navigation in Web Engineering. Advances in Engineering Software. Vol. 38 (4), 267-282, 2007.

Escalona, M.J. and Koch, N. Metamodeling Requirements of Web Systems. Web Information Systems and Technologies. Int. Conf. WebIST 2005 and WebIST 2006, Revised selected papers. Springer Verlag. Vol. 1, 267-280, 2007.

Insfrán, E., Pastor, O., Wieringa, R. Requirements Engineering-Based Conceptual Modelling. Requirements Engineering Journal, Vol 7 (1). 2002.

Olsina, L., Rossi, G. Measuring Web Application Quality with WebQEM. IEEE Multimedia. pp. 20-45. 2002.

The Unified Modeling Language V.2.0. Object Management Group. OMG. 2003.

Vilain, P., Schwabe, D., Sieckenius, C. A diagrammatic Tool for Representing User Interaction in UML. Lecture Notes in Computer Science. UML'2002. England 2002.