

REVISITING REQUIREMENTS IN WEB MODELLING LANGUAGES

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ABSTRACT

As a consequence of the great number of web modelling languages arisen in the last few years, some criteria to compare them have to be given. Thus, a few authors have made a recollection of the requirements that these languages should address, but, due to technological changes some new requirements have arisen and others haven't been addressed by modelling languages, yet. This paper wants to be a stop to review which of the requirements proposed have been overcome, and which ones haven't been yet. On the other hand, we also want to propose some new requirements in order to adapt the languages to the current technological state.

KEYWORDS

Web modelling languages, web design, software engineering

1. INTRODUCTION

In the last few years, the number of applications developed for the Internet has been remarkably increasing due to, on the one hand, the expansion of the Web among the mass audience and, on the other hand, as a consequence of the revolution that the Internet has been in communication world. This widespread demand of web applications has increased their level of complexity, because end users are requesting more and more.

At first, these applications were merely linked hypertext pages, but soon they became information repositories which needed to manage big databases. Thus, some proposals, such as HDM [Garzotto et al., 1995] and RMM [Isakowitz et al., 1995], came to birth in order to fill the gap that traditional methods had left uncovered for the development of web applications.

These first proposals had a hypermedia and database background, and they were focused mainly on the navigation modelling problem, because navigation is one of the distinguishing characteristics of web applications. Later, the OOHDM team [Schwabe & Rossi, 1998] proposed the use of object-oriented models. This idea and the separation of content, presentation and navigation have been adopted by the later proposals.

Although the proposals that came after OOHDM addressed interesting problems unsolved by the previous methodologies, they were at the point of having too many proprietary modelling formalisms. It was necessary to have basic, uniform formalisms throughout the life cycle of a software project; accordingly, new proposals arose to define these modelling languages based on UML [Rumbaugh et al., 1998], such as, UWE [Baumeister et al., 1999] or the one by Conallen [Conallen, 1999].

Therefore, it can be claimed that the evolution of web design methodologies has been an incremental, iterative process, in the sense that every new proposal adds new aspects that weren't treated in the earlier ones.

Currently, there are too many different proposals and there are complex relationships among them (Figure 1 depicts a table with the names of the most important proposals and their acronyms and it also shows a graph representing the relationships among the different proposals). However, due to the great number of different modelling languages some criteria for making comparisons should be given because, we need to know which are the strengths and shortcomings of all of them. Thus, having in mind this aim, a few papers have been published ([Koch, 1999], [Reschitzegger & Schwinger, 2000], [Gu et al., 2002]) whose main

focus was the enumeration of a few basic requirements that web modelling languages should fulfil, and how the different languages addressed these requirements.

However, since the publication of these comparative papers, a few new methodologies have been proposed, also, the previous ones have been reviewed, and, above all, new requirements have arisen due to technological changes. We want this paper to be a stop in order to check which of the shortcomings pointed out in the previous comparatives have been addressed until now, and which ones don't have been yet. Furthermore, we want to propose some new requirements to face up to the technological changes.

Acronym	Acronym stands for
ER	Entity-Relationship Modelling
Dexter	The Dexter Reference Model
OMT	Object-Oriented Modelling Technique
HDM	Hypermedia Design Model
EORM	Enhanced Object Relationship Model
RMM	Relationship Management Methodology
OOHDM	Object-Oriented Hypermedia Design Model
Araneus	Araneus Web-Management System
HPFM	Hypermedia Flexible Modelling Process
UML	The Unified Modelling Language
WSDM	Web-Site Design Method
HDM-Lite	Model Driven Development of Web Applications
SOHDM	A Scenario-Based OOHypermedia Design Methodol.
VHDM	View-Based Hypermedia Design Methodology
UWE	UML-Based Web Engineering
Conallen	
W3B	Web-based Intelligent Information Infrastructure
OO-H	Object-Oriented Hypermedia Method
W2000	W2000 Design Framework
WUML	Web Unified Modelling Language
UWA	Ubiquitous Web Applications Project

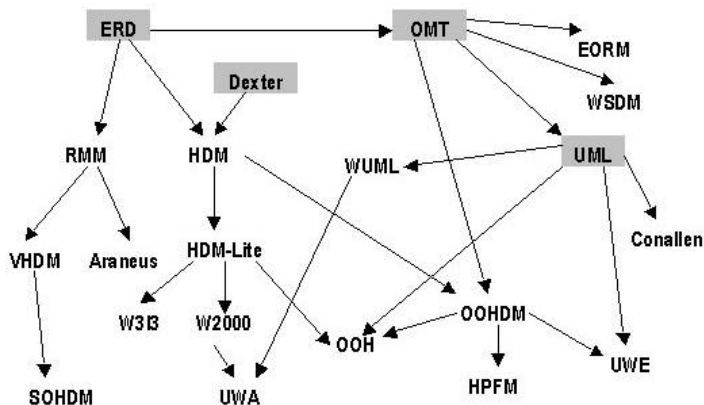


Figure 1. Main proposals, its acronyms and their relationships.

This paper is structured as follows: In the next section, we are going to introduce and explain the conclusions we have obtained after surveying the different modelling languages and the requirements proposed in the previous comparative papers. Section 3 enumerates the new requirements that we proposed. Finally, we conclude the paper.

2. REVISITING REQUIREMENTS

Since the web modelling languages have been surveyed ([Retschitzegger & Schwinger, 2000], [Gu et al., 2002]), the landscape has changed a lot, not only due to the emerging requirements, but also because new proposals have come out and others have been reviewed. Thus, after surveying the most recent proposals to check if the shortcomings have been overcome, we have concluded that:

- Most of the proposals separate presentation, content and navigation, and give a way to map the knowledge among these three levels. For example, OOH [Gómez et al., 2000] defines a set of steps for mapping elements of the navigation diagram to elements of the presentation diagram. They have also addressed the fact of using concepts of the presentation level in a technologically independent way.
- Methodologies haven't overcome at all the distinction between a top-down and a bottom-up design. Currently, just about every proposal begins with the conceptual modelling phase, and this fact implies a top-down design. But nowadays, the World Wide Web has become a repository of structured and unstructured information; therefore, it will be a source of data for web applications, especially those which extract information. The review of this point will be essential in the near future.
- There are other shortcomings that have been partially overcome. The most important one is that although many of the proposals have included UML as the modelling language, there are still many of them with proprietary notations. Another very important one is that patterns are applied mainly during the hypermedia modelling, although there are some of them, such as OOHDM or OOH that have also applied interaction patterns.
- Finally, in spite of the fact that most of the researchers agreed with the need of defining a whole process to develop web applications, there are only a few proposals which define every step and every stage.

3. ADDING NEW REQUIREMENTS

Times are changing and new requirements have arisen due to technological needs. We think that a few requirements more should be added in order to improve the development of a web project. We have surveyed the most important web modelling languages in order to check these new requirements. These requirements are:

1. *The use of a non-diagrammatic modelling language.* This fact will help to automate and improve all the design process, because you are sharing the information in a computer-readable way. In fact, there are proposals that are using the standard XML or some XML-compliant standard. For example, in [Vilain & Schwabe, 2002] the use of RDF is proposed. Moreover, in W3I3 [Ceri et al., 2000], Araneus [Mecca et al., 1998] or OOH [Gómez et al., 2000] the specification is stored in XML.
2. *Modelling of adaptation.* The term 'adaptation' is referred to those applications that are able to adapt themselves to the kind of user who is utilizing it. This fact implies that you need different user interfaces, different navigations or different functionalities depending on the user who is utilizing it. In a field as competitive as the Internet, applications need to have added values, and a way to offer that value is adapting the content or the presentation to the end user. This feature should be modelled in a clear and explicit way in the methodologies
3. *Modelling of ubiquity.* This requirement has arisen due to technological changes. The term has been coined due to the great number of devices that can be hooked on the Internet with the capability of executing applications. The capture of the differences between executing an application in a desktop or a PDA is a new requirement that some new proposals, such the UWA (Ubiquitous Web Applications) project [The UWA Project, 2003], are trying to address.
4. *The use of design patterns at all levels and, also, a flexible way to add new ones.* There are many well-known hypermedia patterns that should be used to improve the design of web applications. In fact, they have been adopted by a few proposals. But some of them use these patterns as constructors in their own models. In this case, if a new pattern is proposed and universally accepted, the model should be modified in order to couple the pattern with the model. Therefore, we need a way to include new patterns in models in a flexible way, and not only hypermedia patterns, but patterns at all the levels.
5. *The separation of concerns not only in hypermedia level.* There is a new way to face up to the development of software known as advanced separation of concerns [Tarr et al., 1999] or aspect oriented programming [Kiczales et al., 1997]. They propose to reason about concerns in a separate way, and then compose the different concerns. Thus, aspects such as security could be addressed. It would be very interesting to address these concerns in web design methodologies, because many of the advantages of using this new software engineering trend can be obtain, that is, changes are additives not invasive, a better adaptability, personalization and reuse can be obtained.
6. *Give an enough, extend and clear documentation of the whole process and the proposal.* Usually web-engineering methods are proposed by the academic community not by the business community, and also it is common that the results are published in proceedings of workshops, conferences or journals. In this sense, it is very difficult to collect all the information in order to have a clear idea of all the processes and stages during the development of the application. Therefore, a clear documentation with lots of examples should be given to understand the proposal. Moreover, this will help to introduce the different methods in the industry.

4. CONCLUSIONS AND FURTHER WORK

This paper has made a review of the different shortcomings detected by some comparatives in the web design methodologies, and has added a few more. The main shortcomings found are the ones related to the disconnection between models and the need to use design patterns in all the levels.

There are some new requirements that have appeared due to the technological changes; they are the need of modelling ubiquity and adaptation features of a web application. There are other requirements that are going to fulfil future needs, for example, the separation of concerns, such as security.

At last, we think that is very important, to have well documented all the proposals, in order to have a better understanding of the processes and phases. In this sense, the UWA project is doing a great job.

On the other hand, web applications become more and more complex, and the access to an information repository isn't enough. Thus, there are new problems that current methodologies have to face. Two of the most addressed nowadays are adaptation and ubiquity.

Moreover, we think there are too many proposals with too many different notations, and we are now in a stage very similar to the one before UML. We think that a standard language for modelling web applications should be given and commonly accepted. A set of people from academia and business world should form a committee in order to propose a standard. This standard should arise from the agreement of the web community.

REFERENCES

- Baumeister, H. et al., 1999. Towards a UML extension for hypermedia design. *In Proceedings of UML'99 The Unified Modelling Language – Beyond the Standard*. Springer-Verlag. Fort Collins. USA.
- Ceri, S. et al., 2000. *Web Modelling Language (WebML): a Modelling Language for Designing Web Sites*. *Computer Networks*. No. 22, pp. 137-155.
- Conallen, J., 1999. *Building Web Applications with UML*. 1st edition. Addison-Wesley Pub. Co.
- Garzotto, F. et al., 1995. HDM – A Model-Based Approach to Hypertext Application Design. *ACM Transactions on Information Systems*, Vol. 11, No. 1.
- Gómez et al., 2000. On Conceptual Modelling of Device-Independent Web Applications: Towards a Web Engineering Approach. *IEEE Multimedia*. Vol 8, No 2, pp. 20-32.
- Gu, Ai. et al., 2002. Web Modelling Languages: the gap between requirements and current exemplars. *In Proceedings of the 8th Australian World Wide Web Conference*.
- Isakowitz, T. et al., 1995. RMM: A Methodology for Structured Hypermedia Design, *CACM*, Vol. 38, No. 8, pp. 34-44.
- Kiczales, G. et al., 1997. Aspect-Oriented Programming. *In Proceedings of the European Conference on Object-Oriented Programming*. Springer-Verlag. Finland.
- Koch, N., 1999. *A Comparative Study of Methods for Hypermedia Development*. Technical Report 9905, Ludwig-Maximilian-Universität München.
- Mecca, G. et al, 1998. The Araneus Web-Based Management System. *In Exhibit Program of ACM SIGMOD'98*.
- Retschitzegger, W., Schwinger, W., 2000. Towards Modelling of DataWeb Applications – A Requirements' Perspective. *In Proceedings of AMICIS'00 America Conference on Information Systems*. Long Beach. USA.
- Rumbaugh, J. et al., 1998. *The Unified Modelling Language Reference Manual*. Addison-Wesley.
- Schwabe, D., Rossi, G., 1998. An Object-Oriented Approach to Web-Based Application Design. *Theory and Practice of Object Systems (TAPOS)*, special issue on the Internet, Vol. 4, No.4, pp. 207-225.
- Tarr, P. et al., 1999. N degrees of separation: Multidimensional separation of concerns. *In proceedings of the 21st International Conference on Software Engineering*.
- The UWA Project, 2003. The UWA Project home page: <http://www.uwaproject.org>
- Vilain, P., Schwabe, D., 2002. Improving the Web Application Design Process with UIDs. *In proceedings of the 2nd International Workshop on Web Oriented Software Technology. IWWOST 2002*. Málaga, Spain.