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Requirements Engineering of Virtual
Applications: Some Initial Thoughts

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Abstract : In this paper, we argue that Web applications, here referred to as virtual applications, pose different kind of challenges to requirements engineering (RE). Our ongoing experience in building an Internet collaborative site exemplifies those challenges. Our virtual application is devoted to the acquisition and compilation of a general requirements engineering bibliography database. Most RE methods and techniques are centered in the communication between stakeholders, i.e., developers, users, and clients, but in the case of virtual applications the usual distinction between stakeholders is not so clear. Another characteristic of virtual applications is the role of technology, which imposes standards which directly constraints the definition space. As such, the traditional sequence from requirements to design phases becomes blurred. We argue that virtual applications require innovative requirements processes.

Keywords: requirements engineering, life cycle, software development, internet applications.

Resumo : Neste artigo apresentamos a hipótese de que aplicações para a Internet, também chamadas aplicações virtuais, colocam novos desafios para o engenheiro de requisitos. Nossa experiência atual na construção de de um site colaborativo serve para exemplificar estes desafios. Nossa aplicação é devotada à aquisição e compilação de uma base de dados bibliográfica em engenharia de requisitos. A maioria dos métodos de engenharia de requisitos disponível é centrada na comunicação entre os usuários, isto é, desenvolvedores, usuários finais e clientes; porém no caso de aplicações do tipo virtual esta distinção não é clara. Outra característica das aplicações do tipo virtual é o papel desenvovido pela tecnologia atual que impõe padrões que restringem o espaço de definição das mesmas. Desta forma, a transição da fase de requisitos para a de projeto, que geralmente se dá de maneira sequencial, fica comprometida. Parte da nossa argumentação se concentra no hipótese de que aplicações do tipo virtual requerem processos inovativos no que tange a fase de especificação de requisitos.

Palavras-chave: engenharia de requisitos, desenvolvimento de software, ciclo de vida, aplicações para a Internet.

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Abstract

In this paper, we argue that Web applications, here referred to as virtual applications, pose different kind of challenges to requirements engineering (RE). Our ongoing experience in building an Internet collaborative site exemplifies those challenges. Our virtual application is devoted to the acquisition and compilation of a general requirements engineering bibliography database. Most RE methods and techniques are centered in the communication between stakeholders, i.e., developers, users, and clients, but in the case of virtual applications the usual distinction between stakeholders is not so clear. Another characteristic of virtual applications is the role of technology, which imposes standards which directly constraints the definition space. As such, the traditional sequence from requirements to design phases becomes blurred. We argue that virtual applications require innovative requirements processes.

1. Virtual applications

A field study of the state of practice in requirements production [Lubars 93] brought to light two important aspects: one is the distinction between requirements engineering for customer-specific projects and for market-driven software and the other is that simpler techniques or tools are used more often than complex upper CASE tools[1]. Both of these aspects are relevant to virtual applications.

The development process for virtual applications is very similar to that of off-the-shelf software. Both lack the traditional elicitation loop between customers/developers [Potts 95] and are very much dependent on the creativity of developers, who have to propose, invent or design the requirements.

A special characteristic of a virtual application the fact that its use in the cyberspace (either the Internet or an intranet), makes possible the emergence of a collaborative process of enhancement and customization not easily achievable by the usual off-the-shelf software.

Another important aspect of virtual applications is the need to follow standards. This need implies a constrained definition and design space. As such, much of the requirements definition tasks will be constrained by the kind of software and standards in use in the Web. For instance, HTML 3.0 is an established standard. This limitation on the other end can be used to drive the definitions.

The point of this paper is not to prove that traditional requirements are either wrong or inadequate for virtual applications. We will present some aspects particular to their

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[1] Recently at the CASE'95 requirements engineering workshop it was reported that in a large company software engineers are changing upper-CASE tools for simpler ones.

development that we believe deserve further investigation. We divide the rest of this paper as follows; Section 2 presents a very brief description of both the state-of-the-art and state-of-the-practice in requirements engineering. Section 3 presents the requirements engineering bibliography project and, Section 4 describes the problems we have encountered while trying to apply traditional requirements engineering during the project. Finally, Section 5 concludes with what we think should be the future direction of research in virtual application requirements engineering.

2. Requirements Engineering

The state of the practice in traditional requirements engineering yields a process that can be summarized as follows: during the requirements stage developers and users work together in order to elicit, model and analyze the problem. Ideally, according to the traditional literature, during the requirements stage there has to be no concern with *how* the system is to be implemented, the goal is to determine the functionality, i.e., *what* the system is supposed to do. Watts Humphrey says, *"requirements can be viewed as a problem statement without a solution. In fact, if the requirements are properly produced, they should not imply a design solution"* [Humphrey95].

From the research point of view of research we have at our disposal today a plethora of techniques to support the basic activities of requirements engineering. For example: a sociological approach derived from ethnography to help the elicitation of requirements [Goguen94], more abstract requirements languages for better modeling reality [Mylopoulos90], and analysis techniques like viewpoint analysis [Leite 91]. These proposals are important for a customer-driven application which requires a large investment at the requirements stage.

We must note that the traditional requirements process is basically a sequential one and in most cases, when completed it produces a document, software requirements specification (SRS) that prompts the beginning of the next stage, namely design. It is during the

design stage that implementational issues are dealt with. In other words developers will choose the most adequate hardware, tools and programming languages to implement the previously specified system.

3. The Requirements Engineering Bibliography Project

The requirements engineering bibliography projects (REB) goals are to provide a list of bibliographical references on requirements engineering available to all and written by all, using the World Wide Web.

A public site was created at the server in PUC-Rio that enables any user to either download a current version of the listings or insert any requirements engineering related publication. Whenever available, publications that have a URL, i.e. can be downloaded using the Web, will be appended to a special list, the Internet Requirements Engineering Resource Page. At first the listings will be available for downloading in the LaTex reference format, i.e. a Bib file. If the user wants to append to the list, he or she can input any publication that is either a book, theses, article, proceedings or part of a publication, such as chapter of a book or article published in a conference proceedings.

Future improvements include providing the bibliographical listing in different formats, typically the ones supported by PC-based environments, such as Word for Windows ".doc" files. We also plan to extend the types of entries so as to incorporate all styles supported by other platforms. We also provide a Requirements Engineering Resource Page that is an on-line guide to publications available through the Web. A subset of the requirements bibliographical listing, this page will contain only publications that can be accessed electronically. We believe that web users are mainly interested in using this very medium to obtain the documents instantly, instead of having to send e-mail to the authors to request hardcopies.

In this light, the decision to suppress the complete listing (while making it available for downloading) and present only the subset of

entries available electronically is a movement towards augmenting the users satisfaction and promoting the Web. We hope our effort will contribute to disseminating the work of the requirements engineering community and will encourage authors to put their publications available to a larger number of people by using the Web.

Knowing the user is not always an easy task. Mitch Lubars describes conflicts among different customers, or between parts of the customer organization that claimed to be "the customer" [Lubars et al93]. This situations is worsen in cases where the product is market driven, i.e, is directed to a certain number of anonymous users. According to Collin Potts other factors, such as marketability and feature comparisons with competing products play roles whose importance surpasses those elicited from "the user"[Potts95].

Although the REB project does not fall into the market-driven application category, it is intended for a large group of Internet users. This group typically includes researchers, students, consultants, and librarians interested in requirements engineering. We cannot claim the existence of a single user model that would consistently reflect the profile of such large community.

It is important to emphasize that the REB belongs to a class of applications that do not have a physical counterpart, i.e., they only exist virtually in some electronic format. These applications can be best characterized by combining a human activity to some computer feature. Examples are electronic encyclopedias, that combine information, query mechanisms, educational software, that combine story books to multimedia features, games, that combine strategies to real time simulations and collaboration software, allowing people from all over the globe to interact asynchronously, for instance a movies database (http://www.msstate.edu/Movies) and pool (http://www.usatoday.com/life/special/oscar_res ults.html).

4. So What is Wrong

The standards imposed by the Web on the format of virtual applications has direct consequences to the process by which they are designed. Software developers and practitioners must conform to reduced sets of interface solutions and other limitations presented by HTML. If, on one hand, the current standards for Web practice constrain the definition of its applications, then on the other hand, they present simpler solutions, guidelines, and examples that facilitate their development.

There seems to be a consensus to Perl and C being the best languages in which to implement Virtual Application functionality (CGI). The existence of public-domain cgi libraries allied to reuse practices both facilitate and accelerate the development of applications. On the user side, the standard interface reduces navigational complexity and allows them to transfer knowledge from one application to another, thus reducing the learning curve for new applications drastically.

In the case of Virtual Application development one must conform to existing technologies to support such media. Although desirable, not all features of traditional software can presently be implemented on a Web based project. The speed of data transfer constrains the developer to make interaction with distant sites feasible. In addition the look and feel of the applications are restricted to those provided by the building blocks supported by current version of HTML. Finally security issues must be taken into account .

Traditionally impletational issues emerge during the design stage, by which time the SRS should be completed. In other words, the technology that best implements the functionality of the system stated in the SRS is chosen only when the developers have a very clear idea of what the system is supposed to do.

This cannot be the case in the development of REB. The idea to built the application in the Internet was the starting point. This directly implied the use of HTML and some supported scripting language, independently of the nature of the application.

Therefore we started out knowing many details how to do it but not what to do.

The point of this paper is not to prove that traditional requirements is either wrong or inadequate. We want to paint out a situation that came up in practice and that needs more attention. We believe from what we understand of virtual applications and requirements engineering that special consideration should be given to the following aspects.

a) lack of a precise definition of context,
b) the multitude of users,
c) the difficulty of establishing a user profile,
d) the constraints imposed by technology,
e) the GUI approach of virtual applications,
f) the availability of components in the net, and
g) the ease of use of Web browsers.

We believe that these aspects should be further investigated in order to:

a) derive a meta process for virtual applications,
b) propose methods, techniques, and tools for the task of defining virtual applications, and
c) integrate the meta-process and the MTT with the available standards and software available at the Web.

Notwithstanding the fact on that the requirements processes will be lighter than normal we foresee that several aspects related to non-functional aspects of the requirements process need to be further investigated. For instance, some non-functional aspects are constrained by the technology. However there are others. For instance, local law and regulations are difficult to predict.

5 Conclusions

The Web technology is bringing up new kind of software systems, which heavily depend on collaboration over the Internet. Visions of the future [Gates95] make us believe that this kind of application will be more and more popular. We named them virtual applications. It is true that most of the examples and systems in use are not as complex as some market-driven software.

Nonetheless they still ought to be built using methods, tools, and techniques put forward by software engineering.

In this context and based on hands-on experience we foresee the need for customization of some existing methods, tools, and techniques that support elicitation, modelling and analysis. This customization, we believe, will be very much oriented a learning approach [Malerba91] since the Web is becoming a very wide source of global knowledge.

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