BUSINESS FRAMEWORK FOR INTERACTIVE APPLICATION DEVELOPMENT

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ABSTRACT

This paper reviews relevant frameworks of analysis for application development approaches and business model methodologies in the presence of uncertainties. Such uncertainties affect new media applications by undermining their innovative power. Emergent value chains and emergent requirements are first considered to classify different application development approaches. Then, a user-centric based mechanism and its associated business model are proposed to facilitate the participation of all stakeholders to the different aspects of the service development. The association between the different stakeholders is illustrated, in the case of interactive media applications, through a novel functionality within the business model: the "interactivity manager" entity.

Keywords: Application development, user-centric, business models, interactive media.

1 INTRODUCTION

Whilst a vital element of any viable commercial project, business models remain an elusive notion in the existing literature. All too often, though, business models are merely envisaged as a 'black box' determined only by a limited number of stakeholders.

The problem can be summarised as follows. A small group of modellers entirely controls the choice of derivation method – hence final form – of the business model. However, this problem is pervasive to all stages of application development. In the absence of a taxonomy of application development approaches, no criteria exist to identify which methodology is better suited to the problem at hand.

Implicitly, it is assumed that all available approaches – provided they are applied correctly – are conducive to equivalent applications and related business models. Similarly, it is assumed that no specific approach is better suited to addressing given types of issues.

The resolution of such questions is critical to the development of innovative applications brought forward by digital convergence, such as interactive media applications.

1.1 Value chain integration

Emergent business models are attained through systematic value-chain destruction and re-construction. Opportunities to integrate the value-chain appear through the identification of requirements for the application being developed. In contrast to other types of requirements, those that emerge during the application development process best capture the potential to generate innovative business solutions. The methodological approach employed during the application development process is therefore critical. The commercial viability of the application provides the incentive to adopt an approach that promotes the identification of emergent requirements. The approach should also be flexible enough to adapt to mutations of the original application specifications.

1.2 Emergent requirements

Dobson *et al.* [1] identify six types of requirements which vary not only in terms of their degree of persistence or rapidity of obsolescence, but also in terms of their purpose. *Enduring* requirements are stable through time and reflect the fixed technical core of the business and fixed non-functional influences, such as social norms or company culture. Enduring requirements are the only stable type of requirements. All other types of requirements evolve through time.

Mutable requirements address external influences on the application which require rapid adaptation: technical innovations, governmental or legislative changes, new management styles, evolution of markets, etc. The remaining types of requirements address changes within the industry or company, rather than external changes.

Emergent requirements emerge during the application development process. They enhance the definition of developmental goals and warrant stakeholders' commitment to the project.

Acknowledgement: This work was partially supported by the EC-funded IST project 1999-11288 NexTV. The authors wish to acknowledge the valuable contribution that their colleagues in NexTV have made in this paper.

Consequential requirements arise when users modify their behaviour in response to the introduction of a new application, which in turn modifies users' requirements. Pilot schemes, prototypes, demonstrations and scenarios can help identify such requirements prior to the implementation stage. By doing so, consequential requirements become emergent requirements. *Adaptive* requirements mirror users' desire for customisation and personalisation. *Migration* requirements arise due to structural changes and are limited to the transition period.

2 CLASSIFICATION OF APPLICATION DEVELOPMENT APPROACHES

2.1 Framework of analysis

A possible classification of different application development approaches revolves around the level of acknowledgement and mode of treatment of the uncertainty of requirements. Uncertainty arises from the fact that user needs and requirements are both too pervasive to be captured exhaustively and evolve over time.

2.1.1 Classification

For any given new media project, explicit representation of significant uncertainties of requirements is a decisive factor in the choice of application development approach [2]. Such a criterion is therefore used to build a meaningful classification of application development approaches.

Four binomial steps are used to describe the presence of provisions to handle specific types of uncertainties in the application development process.

At the most basic level, the classification checks whether a given approach acknowledges the presence of any type of requirements uncertainty.

The next stage considers whether the approach allows for a static comparison between the statement of requirements at a given point in time, and the characteristics of alternative implementations suggested at that date. Such implementation uncertainties are known as "*solution uncertainty*". The task extends beyond optimisation (selecting the superior implementation within the set proposed), to raise awareness of uncertainties that remain attached to the chosen implementation.

A further step consists in establishing whether the approach evaluates the ability of the stated requirements to deliver the desired outcome, under the assumption that no implementation barriers exist. The terminology "*problem uncertainties*" thus regroups all uncertainties attached to the process of gathering and prioritising requirements.

In a fourth and final step, the classification examines whether human requirements take precedence over other types of requirements. An application development approach can revolve around one of three levels of functionality, namely: data, processing and user [3]. The rationale for the central role of the user layer over the processing or data layer stems from the nature of requirements in each layer. Indeed, human requirements are more volatile than processing or data requirements. Furthermore, human requirements have the ability to evolve over time independently of non-human requirements. Therefore, the optimisation criteria in the user layer are fundamentally different from the criteria used in other layers. For instance, key criteria in the user layer include usability and adaptability to a fast-changing business environment. Criteria in the non-user layers, such as throughput or data integrity, do not reflect human-related concerns such as ease of learning, ease of use or dynamic evolution through time.

2.1.2 Development Integration

It is therefore recommended that new media application development approaches should test positively in each of the four classification steps. Outside the classification, such recommended approaches will be all the more effective depending on their potential to bridge the gap between the requirements analysis phase and the implementation phase. In other words, more robust approaches reconcile solution and problem uncertainty, given the idiosyncracies of the project. For instance, the approach may indicate how users and developers evaluate the requirements, how familiar the users or developers are with the form of the statement, and what mechanisms are used to trace the requirements in the implementation phase.

It is in this context that we include in the business model to be introduced in Section 3 a key entity that facilitates the development integration phase. The *Interactivity Manager* (IM) entity allows all stakeholders to participate in a "Virtual IM Forum", thereby facilitating consensus-building throughout all stages of the application development.

2.2 Application development approaches

Four different types of approaches have been identified as possible candidates to deal with underlying uncertainties on application requirements.

2.2.1 Waterfall Approach

In a 'sequential' or 'waterfall' approach, completion of one level in the development process leads automatically and irreversibly to the next developmental stage.

A waterfall approach does not explicitly acknowledge uncertainty of requirements and it is limited in its ability to minimise the impact of errors. In the absence of communication with users, there is no potential to revert to an earlier stage, and hence some errors may not even

be detected until the application is marketed.

2.2.2 *Life-Cycle Approach*

A life-cycle approach is one where developers re-evaluate requirements and update the application at fixed dates of the application's life-cycle.

This type of approach acknowledges the presence of uncertainties and attempts to reconcile a set of proposed solutions with a static statement of requirements.

However, such an approach provides no indication as to how the user will evaluate the requirements. Furthermore, requirements typically appear in a form ensuring direct translation into the work of developers, rather than comprehension and discussion by users.

2.2.3 *Incremental Approaches*

A broad range of more refined approaches are covered under the generic denomination of 'incremental'. They all proceed sequentially. For instance, the *minimum critical specification* approach concentrates on deriving the minimum set of stable – rather than emergent – requirements to be met to improve perceived user value levels. Other approaches include the *requirements capture-specification* or *spiral* approach, whereby areas of increased uncertainty are discarded in a sequential fashion.

In terms of the classification, incremental approaches improve on life-cycle approaches to the extent that they focus primarily on human requirements.

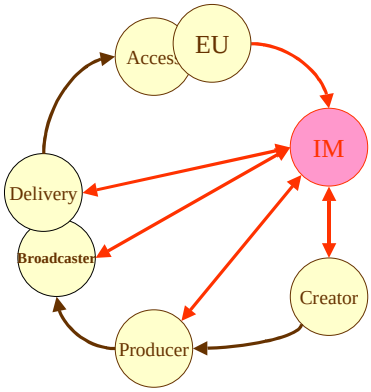
2.2.4 *User-Centric Approach*

The aims of a user-centric evaluation are three-fold: agreement between application's functionality and users' requirements; derivation of optimal user interface through user tests; identification and resolution of difficulties reported by users [4].

3 USER-CENTRIC APPLICATION DEVELOPMENT APPROACHES

For evolving application development, we propose a simple and flexible framework suitable for consensus building. This framework aims at aiding the different stakeholders in new emerging value chains in their determination of new business models. According to the above classification, user-centric approaches acknowledge uncertainty of requirements, address both solution and problem uncertainties, and focus on human requirements. The proposed framework is therefore inspired on user-centric principles which are generalised to support evolving interactive application developments by means of the interactivity manager (IM) entity.

An instance of such a business model is offered by the EC funded *NexTV* project [5] in the case of interactive television applications. Figure 1 presents the more basic instance of this framework in which all stakeholders are present. The framework is well suited to an overall business framework analysis as well as to the analysis of specific aspects of the business.



IM = Interactivity Manager
EU = End User

Figure 1: ***The NexTV project Interactive Supply Value Loop and the Interactivity Manager (IM)***

Two underlying principles of a user-centric approach render it the more appropriate to support application development with evolving user requirements.

3.1 User involvement maximisation

As many different types of users (stakeholders) as possible must be involved in the application development process [6]. Involvement may take the form of direct participation, influence on decisions and veto rights, or communication with decision-makers.

Decentralisation is an important factor in achieving greater levels of involvement. In this context, the IM facilitates finding and sharing information as well as identifying communities of interest. Two consequences ensue. A more efficient use of resources is achieved when interested stakeholders are able to advertise their core competence application features. Furthermore, social benefits are significantly enhanced since End-users derive higher levels of utility from personalisation and customisation of the application services.

3.2 Standard Interfaces and re-usable components

Users need to exchange complex information on a mixture of strategic and mundane requirements. An effective communication network will enhance the productivity of the development team in two ways. Communication through standardised interfaces allows members with different specialist knowledge to communicate in a commonly understood language. In turn, enhanced communication reduces the length of the

development process by identifying independent issues which can be researched in parallel.

Standardised interfaces and re-usable components enable such a communication infrastructure. The use of standardised interfaces is more cost-efficient than implementing a series of one-to-one communication protocols between all development team members. Re-usable components enhance the productivity of the application development process together with the quality of the application developed, whilst avoiding the costs of re-inventing existing technologies.

In this framework, the IM may play the role of a translator of and clearing house for the original mixture of requirements. This is particularly critical in the transitional period until interfaces are well-established, and a proper classification of requirements is agreed.

4 USER-CENTRIC LOOPS

The concept of a user-centric loop is therefore proposed to encourage the communication between the economic or business realm and the technological realm. An application worth developing and commercialising must reconcile the two realms.

A user-centric loop arises when communication is established between the various stakeholders involved in the same independent area of the application development process.

In this framework the IM is a "Virtual Forum" and point of contact of the user-centric loops and hence plays a key role during the development phase.

Activities within user-centric loops follow a dynamic process. During the initial stages of application development, loops may need to occur in a pre-defined sequential order. Some loops may be able to occur simultaneously when independent activities are engaged in. This feature of the user-centric approach guarantees that new users, usages or technologies are incorporated within the application as they emerge.

Finally, with the same views as in [7], the proposed framework is well suited for the sequential use of business modelling and scenario development. Business models provide a general background, whilst scenarios palliate to models' lack of specificity.

5 CONCLUSION

The generation of innovative new media applications relies on the potential of the application development approach to detect and adapt to emergent requirements. A classification of such approaches allows project members to make an informed decision when adopting any application development approach.

The connection between the user-centric approach and the application development process has been described throughout this paper. The user-centric approach ensures that volatile requirements are captured in a stable manner by the business model. Furthermore, key issues identified for application development can be addressed by partners co-operating via on-going user-centric loops.

The concept of *Interactivity Manager* is then presented in the case of interactive television application development. This new functionality revolves around the coordination of stakeholders with the purpose of consensus-building and facilitating the application development process.

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