Usable M-Commerce Systems

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INTRODUCTION

Today, the PC is only one of many ways to access information resources. Traditional computing technology has become more mobile and ubiquitous and more and more computing tasks are possible to do using new types of mobile devices.

According to Siau, Lim, and Shen (2001), the essence of m-commerce (also termed "mobile information systems") is to reach customers, suppliers, and employees regardless of where they are located and to deliver the right information to the right person(s) at the right time. The ability to develop and evolve usable m-commerce systems is becoming increasingly critical for enterprises.

BACKGROUND

M-commerce systems differ from more traditional information systems along several dimensions (Krogstie et al., 2004). We have grouped the differences into three areas:

1. User-orientation and personalization
2. Technological aspects including convergence and need for multi-channel support
3. Methodology for development, evolution, and operations to ensure organizational returns

User-Orientation and Personalization

M-commerce systems often address a wide user-group, which means that user-interface aspects should feature prominently and early in the design process and often need to be very simple. A number of examples exist indicating that complex services often do not get adopted (Blechar, Constantiou, & Damsgaard, 2005; Steinert & Teufel, 2005). Input and output facilities of the end-user device may be severely restricted (no keyboard, small screen-size, etc.) or based on new modalities (speech-recognition and -synthesis). This means that personalization of mobile information systems becomes increasingly important, both at the individual level where user-interface details are tailored to personal preferences and hardware, and at the work-group level where functions are tailored to fit the team's preferred way of working.

Personalization means information systems that both automatically adapt themselves to the preferences and context of the user, and that can be explicitly tailored by users. The main goal is to achieve usability of the applications on all possible interfaces, based on adaptation to the different physical devices. This calls for intelligent, adaptive, and self-configuring services that enable automatic context-sensitivity and user profiling (Hella & Krogstie, 2006).

Technological Aspects Including Convergence and Multi-Channel Support

Mobile devices still have limited processing, memory, and communication capacities compared to what one are familiar with on traditional PCs. Performance considerations therefore is still important, as is bandwidth analysis. Analytically-based predictive methods are necessary in order to assess a large number of alternatives during the design (Gruhn & Köhler, 2006). M-commerce systems also pose new challenges to achieving information systems dependability. The new mobile devices provide integration and convergence of technologies into a wide range of innovative mobile and multi-modal applications. Mobile and other new technologies provide many different ways to offer the same or similar services. Thus, there is a need for novel approaches for the development and evolution of applications on and across different mobile and traditional platforms.

Methodology for Development and Operations to Ensure Organizational Return

M-commerce systems are often radically different from the existing systems. They therefore reward an increased focus on idea generation early in the requirements and design process. Understanding the mobile users requirements for new services is thus of large importance. One needs both to be able to develop these systems and to address the major hurdles for the deployment of applications and services (Amberg, Wehrman, & Zimmer, 2004). Another effect of the radically new approaches is that the introduction of m-commerce systems often spawns several other initiatives for changing other information systems and processes within an organization. It is important to focus on the interoperability of services and seamless access to corporate and government resources from the mobile devices (Pernici, 2006). A model-driven approach appears to be a promising approach to address many of these methodological challenges.

STATUS FOR MODEL-DRIVEN DEVELOPMENT AND EVOLUTION OF USABLE M-COMMERCE SYSTEMS

When speaking about model-driven system development, we refer to models developed in languages that have the following characteristics:

- The languages are diagrammatic with a limited vocabulary (states, classes, processes etc).
- The languages utilize powerful abstraction mechanisms.
- The languages have a formal syntax and semantics. The formal semantics is either operational enabling, for example, generation of other models including executable programs or mathematical enabling advanced analyses.
- The languages are meant to have general applicability across problem domains.

Although most software developers are aware of model-driven methodologies, they are traditionally mostly used in initial development stages. Newer approaches such as model-driven architecture (MDA) and especially service-oriented architecture (SOA) on the other hand appear to be changing this (Pernici, 2006).

In general, a model-driven approach to information systems development can be argued to have the following advantages (Krogstie & Sølvberg, 2003):

- Explicit representation of goals, organizations and roles, people and skills, processes and systems
- An efficient vehicle for communication and analysis
- Basis for design and implementation
- Readily available documentation as a basis for extensions and personalization

One striking aspect in connection to contemporary information systems development and evolution is that there is an increasing demand for shorter development time for new products and services (Pries-Heie & Baskerville, 2001). This is specifically important for m-commerce systems, where the convergence of different platforms continuously creates opportunities for new functionality. Some would argue that this highly dynamic situation would make model-based approaches impractical. To the contrary, we claim that this means that systems must be developed for change, which make model-based techniques specifically useful.

We can identify the following areas for potentially increased utility of techniques developed as part of model-driven development:

- **User-orientation and personalization:** Traditionally, support for workers performing nomadic processes has not been provided. Recent approaches to workflow modeling is starting to take the specific aspects of m-commerce systems into account (Modafferi, Bentallah, Casati, & Pernici, 2005; Sørensen, Wang, & Conradi, 2005). Functions of the mobile information system should be tailored to fit the user's preferred work processes, which typically involve other persons. To support teamwork, raising awareness of the status of knowledge resources is increasingly important in a mobile setting. To enhance social mobility, organizations and industries need to develop "social ontologies," which define the significance of social roles, associated behaviors, and context (Lyytinen & Yoo, 2002). Given that knowledge resources include both individuals and technology that can be mobile, one should look into interactive systems to improve group performance. Wegner's interaction framework (Wegner, 1997) was inspired by the realization that machines that must interact with users in the problem solving process can solve a larger class of problems than algorithmic systems computing in isolation. The main characteristic of an interaction machine is that it can pose questions to human actors (users) during its computation. The problem solving process is no longer just a user providing input to the machine, which then processes the request and provides an answer (output), but rather is a multi-step conversation between the user and the machine, each being able to take initiative. A major research question in this area is how to specify and utilize interaction machines on a multi-channel platform. Process support technologies are a natural choice for enabling interaction machines. Such technologies are typically based on process models, which need to be available in some form for people to alter them to support their emerging goals. Thus, interactive models should be supported (Krogstie & Jørgensen, 2004). The outset for this thinking is that models can be useful tools in a usage situation, even if the models are changing and incomplete. The user is included as an interpreter and changer of the models.
- **Technological aspects including convergence and multi-channel support:** There is a multitude of competing technologies available for providing the underlying infrastructure and access devices for distributed and mobile applications. A central element when addressing this is the development of model based specification techniques that are powerful enough to be used as a basis for the development of systems on a large number of technical platforms, but still general enough to represent the commonalties at one place only. One interesting approach is the use of architectural patterns (Risi & Rossi, 2004). A major initiative within