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An Adaptation Architecture Dedicated to Personalized Management of Multimedia Documents

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ABSTRACT

Currently, the democratization of wireless communication means coupled with the advanced technological hardware can offer portable devices that fit in the hand with a very large capacity of computation such as PDAs, mobile phones and even wireless sensors. The users' preferences, in which the document is presented, may need to be considered because the adaption of multimedia content through them is an important aspect of Quality of Service. Our research work focuses on the adaptation of multimedia documents with a strong interest on the interaction based on the user preferences. In this paper, we propose formal definitions of concepts related to the technical adaptation that selects a relevant policy in order to perform an adapted document in the situation where conflicts are detected between the heterogeneity of multimedia document properties and the user needs. We present also an architecture for adapting multimedia contents based on the preferences and we develop a user preference interface. We illustrate the proposed approach with a case study.

KEYWORDS

Adaptation, Aspect Oriented Programming, Multimedia Document, Quality of Service (QoS), User Context, User Preference

INTRODUCTION

Today, computer systems are increasingly pervasive, they are built over heterogeneous components and they offer features with complex interactions (Derdour, Dalmau, Roose & Ghoualmi Zine, 2010). MultiMedia Documents (MMDs) are specified in two different ways: future professionals have to be educated to perform the complex task of multimedia object creation, and they are also successfully used in various phases of the educational process (Cvetana, & Aleksandra, 2014). The implementation of multimedia applications is frequently made on the basis of components and services of MMDs to be adapted to the changing conditions (users, equipment, and so on.). Unfortunately, most of these adaptations are essentially based on the hardware and the user context. But, they do not consider the user's preferences. Currently, MMDs must be run on many platforms (mobile phones, PDAs, etc.). The data variety has been one of the most critical features for multimedia big data. Therefore, the way to manage and retrieve MMDs reflecting the users' intentions in heterogeneous big data environments has become an important issue (Kehua, Wei, Mingming et al., 2015). The mix of uses and media requires the adaptation of documents to their execution context, unpredictable at the time of design document (Hai, Laborie & Roose, 2012; Laborie, Jérôme & Layaïda, 2011). In addition, the users are not all interested in the same information and they do not have the same expectations,

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knowledge, skills or interests. They are able to understand or to accept the services and documents in organization, content, modes of interaction and presentation, tailored to their needs and profiles.

The content used in an adaptive system can be very heterogeneous. Content servers can transmit a variety of formats and feature-rich documents. Complex content can be requested by a device which has limitations of processing, display, and so on. To ensure a good Quality of Service (QoS), the system should be able to transmit and translate this complex content to be compatible with the abilities and preferences of the end user. Two types of adaptation are generally considered: individual adaptation of multimedia objects and adaptation of the document structure or composition (Laborie et al., 2011).

The design of an architecture that adapts the multimedia content to any user in an heterogeneous web environment is a challenge. The currently proposed solutions do not address the problem of adaptation with complete architectures. They try to provide means to very specific needs such as adapting images for mobile, video transcoding, and so on. These solutions are often based on how pure programming, following closed and little flexible approaches. Therefore, it seems important to study how to make an adjustment more open and flexible and thus to cover several types within a single architecture (Lemlouma, 2004; Dietmar, & Klaus,2007).

These solutions are specific and are limited to some aspects of the environment (the size of the screen for resizing images, network throughput for transcoding video, and so on). It is due to the fact that there is no model that takes into account all the aspects of the context, nor a model for the description of terminal characteristics and of user preferences to guide a content adaptation process (Lemlouma, 2004). The consideration of the context is incomplete and does not consider all the entities that can control the transmission process of relevant contents. Then, we define an approach to identify all the adaptation elements and their characteristics, starting with the user him-self and the content, which may be requested.

If a model describing the characteristics of the environment is necessary, but it is not sufficient to answer to the requests coming from client applications. Indeed, this description must be accompanied with a technique establishing a correspondence between the different dimensions of context. This technique should be as complete as possible, considering all the possible adaptations. The difficulty is that there are no single source constraints. Indeed, each component of the network (client, network, server, and so on) can set its own constraints and the manager of QoS to find a compromise between these constraints.

In this paper, we propose an architecture dedicated to the adaptation process of MMDs and to the search technique of relevant adaptation services. The basic idea of our approach follows the principal steps. Firstly, a user requests a MMD with their preferences using an interface. The media properties of the document, the target user context and their user preferences are compared in order to detect some conflicts. Then, from the set of these last, an algorithm determining the adaptation policy specifies is executed in order to translate the initial document. Finally, the adapted document is performed and it is provided to the user.

This paper is organized as follows. Section 2 presents some related work and some architectures for adapting MMDs. An overview of our approach is provided in Section 3. Section 4 regroups the formal presentations of adaptation concepts, followed by Section 5 that describes our architecture and its components for developing adaptable MMDs. Section 6 defines the adaptation technique of MMDs with the AOP (Aspect oriented programming) paradigm. Section 7 illustrates this architecture with a scenario in which our proposal is applied. Finally, Section 8 draws some concluding remarks and perspectives.

RELATED WORK

The development of multimedia applications for pervasive computing presents a number of challenges for software engineering, including in particular the different adaptation types of context-aware applications: the adaptation to the environment (location, time, condition, and so on.), connectivity