Chapter 10
On Using Multiple Disabilities Profiles to Adapt Multimedia Documents:
A Novel Graph-Based Method

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ABSTRACT

Currently, advanced technological hardware can offer mobile devices which fits in the hand with a capacity to consult documents at anytime and anywhere. Multiple user context constraints as well as mobile device capabilities may involve the adaptation of multimedia content. In this article, the authors propose a new graph-based method for adapting multimedia documents in complex situations. Each contextual situation could correspond to a physical handicap and therefore triggers an adaptation action using ontological reasoning. Consequently, when several contextual situations are identified, this leads to multiple disabilities and may give rise to inconsistency between triggered actions. Their method allows modeling relations between adaptation-actions to select the compatible triggerable ones. In order to evaluate the feasibility and the performance of their proposal, an experimental study has been made on some real scenarios. When tested and compared with some existing approaches, their proposal showed improvements according to various criteria.

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INTRODUCTION

Today, computer systems are more and more pervasive and can be used in different contexts related to environment, preferences and device capabilities of users. Multimedia documents accessed through mobile devices are most of the time composed of several media objects such as videos, audios, images and texts. Nevertheless, several contextual constraints (e.g., users, equipment, etc.) may prevent the user from correctly playing / exploiting specific multimedia documents on a target device. Thus, adaptation of these documents is required to comply with current constraints that are specified in a profile. Adaptation approaches transform documents' contents according to profile constraints using some discovered adaptation services. For instance, audio contents may not be played when the user is located in a shop. In this particular case, it might be possible to replace audio contents with texts.

In the literature, the existing multimedia documents adaptation approaches can be classified, essentially, into four main categories: (1) Server-Side Adaptation where clients (devices) may request adaptations from the server which is responsible of such task (e.g. Jannach and Leopold, 2007; Bettou and Boufaida, 2017; Alti et al., 2017; Lakehal et al., 2018); (2) Client-Side Adaptation where each device adapts documents by itself (e.g. Belhadad et al., 2018; Laborie et al., 2011); (3) Proxy-Based Adaptation where a proxy acts as a mediator between a client and a server (e.g. Dromzée et al., 2013); (4) and Peer-to-Peer Adaptation (e.g., Hai et al., 2012; Kazi-Aoul et al., 2008). Some of these frameworks exploit semantics benefits to describe profiles' information (Dromzée et al., 2013; Alti et al., 2015). However, they do not use Rule-based reasoning mechanisms upon such information to assist the adaptation process and to deduce efficiency adaptation actions from profiles according to dynamic changes affecting the current contextual situations.

To overcome this issue, the authors in (Saighi et al., 2017) have proposed an architecture called HaMA (Handicap-based architecture for Multimedia document Adaptation) that corresponds to each physical handicap a set of contextual situations. In this architecture, the context-aware assistance is provided by reasoning upon context restrictions to deduce the corresponding physical handicap and therefore inferring the adaptation action. For example, when a user is located in a shop, the deduced handicap and adaptation action are "Deaf" and "Exclude audio", respectively, since the explicit contextual constraint specified in the user profile is "Disable sound when inside a shop". The handicap-based approach allows, on the one hand; reducing the number of adaptation possibilities since several constraints may correspond to the same handicap and, on the other hand, triggering the adaptation process only when the deduced handicap changes according to significant internal profile's updates (i.e. it is not triggered when profile's quantitative values change slightly given that the profile's quantitative information evolve frequently over time). The aim is to guide the adaptation process towards relevant solutions that avoid system overloading. Note that HaMA is not dedicated to real disable communities but inspired from real physical handicaps by choosing the adaptation situations which are closest to handicaps.

Nevertheless, HaMA focuses only on situations corresponding to mono-handicap triggering one single action at a time, which is not sufficient to solve many real-world contextual situations composed of several constraints. In other words, it does not consider complex situations corresponding to simultaneous multiple disabilities that may trigger several adaptation actions. Indeed, when the maximum of profile constraints is considered, adaptation solutions best meet the needs of users. For instance, when the user is located in a street while it is raining, the corresponding handicaps would be: "Deaf" because of the ambient noise and "Blind" because the user cannot read texts on his/her mobile while it is raining. Therefore, the deduced adaptation actions would be "Exclude audio" and "Media-to-Speech".