Scalable Multimedia Documents for Digital Radio

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ABSTRACT

In this paper, we demonstrate the adaptation of multimedia digital radio services in broadcast environments based on scalable multimedia documents. The authoring of our multimedia services relies on the *Scalable MSTI* model that decomposes multimedia documents into three ordered dimensions: *Spatial*, *Temporal* and *Interactive* descriptions. Our demonstration shows *Scalable MSTI* multimedia documents that can be adapted to typical T-DMB digital radio usage scenarios.

Categories and Subject Descriptors

I.7.2 [**Document and Text Processing**]: Document Preparation – *Languages and systems, Multi/mixed media;* H.1.1 [**Models and Principles**]: Systems and Information Theory*;* H.5.1 [**Information Interfaces and Presentation**]: Multimedia Information Systems.

General Terms

Algorithms, Design, Languages.

Keywords

DMB digital radio, multimedia radio services, document adaptation, multimedia scalability.

1. INTRODUCTION

The heterogeneity of T-DMB digital radio terminals in terms of screen resolution, processing capabilities or available decoding memory is a challenge for multimedia document authoring. In order to cope with cheap handsets that usually constrain the design of broadcasted services, it is critical to design broadcast-friendly adaptation techniques.

Indeed, specific constraints should be considered in broadcast environments. First, since no return channel is available, or not always available, the adaptation intelligence must be transmitted along with multimedia services. Hence, adaptation directives should have a compact representation that minimizes bandwidth requirements. Second, the adaptation process is achieved on end-user terminal that may be highly limited in terms of processing power. Therefore, broadcast-friendly adaptation techniques must minimize computing overheads. Such adaptation requirements are addressed by incremental scene updates that can efficiently complete the spatial adaptation of broadcasted multimedia documents [1].

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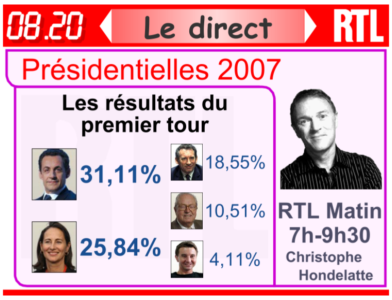

Figure 1. A multimedia Digital Radio document example

Additionally, multimedia digital radio services target a wide spectrum of usage conditions such as "at-a-glance" services for low-cost clock radios, interactive services for kitchen radios (e.g. fast interactive access to weather forecast), connected services for 3G mobile phones and Wi-Fi enabled handheld terminals, no-motion services for car radios while driving… These use-cases trigger the need for adaptable multimedia services relying on the activation of essential properties of multimedia scenes: *Spatial*, *Temporal* and *Interactive* dimensions. The *MSTI* model defined in [2] specifies a *Spatial* component that describes the layout and the style of a static multimedia presentation. This spatial layout may be complemented with a *Temporal* description that provides an automated access to content extensions and defines appealing animations. Finally, the presentation may be enhanced with an *Interactive* description that grants the user on-demand access to other media elements and improves the user experience through an enhanced interface. The three components of the *MSTI* model can be freely combined to address various usage scenarios such as radio receivers without any interface to access content extensions (e.g. clock radio) or usage conditions that do not allow any animation (e.g. car radio while driving).

The *Scalable MSTI* model [2] demonstrated in this paper in the T-DMB digital radio context extends the *MSTI* model with the incremental scene updates defined in [1] and provides advanced adaptation functionalities that are illustrated in Section 3. First, the context of this work is described in Section 2.

2. CONTEXT

The Terrestrial Digital Multimedia Broadcast standard [3] used for digital radio in France specifies interactive services that will augment the audio experience. The MPEG-4 BIFS scene description format [4] is referenced as the interactive standard of T-DMB services. Therefore, scalable multimedia documents presented in this paper have been generated using MPEG-4 BIFS. As illustrated in [2], *Scalable MSTI* documents can also be created in other multimedia formats such as SVG.

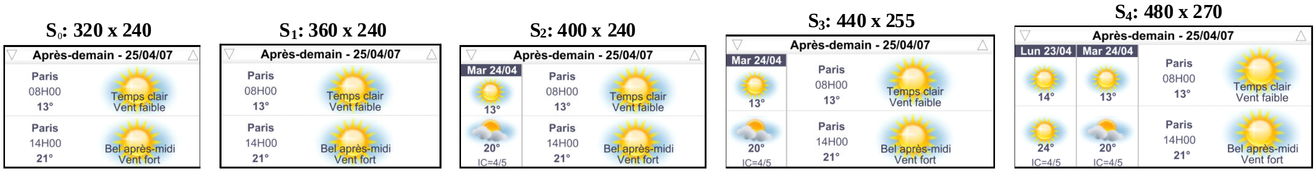

Figure 2. A spatial scalability example

The MPEG-4 BIFS standard specifies a scene update mechanism that allows the streaming of timed modifications applied to multimedia scenes. The *Scalable MSTI* model can take advantage of BIFS *Insert*, *Replace* and *Delete* commands to carry out efficient adaptation in broadcast scenarios. As a consequence, the *Spatial*, *Temporal* and *Interactive* descriptions of our *Scalable MSTI* documents have been binarised into BIFS updates during authoring. These updates are then processed by the BIFS player according to its capabilities and configuration.

Regarding software implementation, the MPEG-4 BIFS encoder and player used to demonstrate *Scalable MSTI* documents are open-source developments of the GPAC project [5]. Radio services are demonstrated on handheld terminals: Samsung i780 (Windows Mobile OS) and Nokia N800 (Maemo Linux OS).

3. EXAMPLES TO BE DEMONSTRATED

Some multimedia scalable documents that relate to typical adaptation use cases for T-DMB Digital Radio are illustrated in this section. More scalable multimedia documents and validation tests can be found at http://www.tsi.enst.fr/mm/MSTI.

3.1 Spatial scalability

The multimedia document depicted in Figure 2 is composed of 5 progressive *Spatial* layers that have been designed to enrich the multimedia service for receivers featuring a large resolution. These *Spatial* layers also provide an optimum layout for different screen aspect ratios (4:3, 3:2, 5:3, 16:9) and avoid presentation distortions caused by scaling (or unused areas on a screen).

Specific configurations on radio receivers could also be defined to help partially-sighted persons by proposing large fonts and appropriate layouts. Such an application scenario requires a custom authoring but can rely on the *Scalable MSTI* model to describe and signal appropriate *Spatial* layers.

3.2 Temporal scalability

The timed properties of the *Scalable MSTI* document illustrated in Figure 3 are divided into 3 *Temporal* layers: T_0, T_1 and T_2.

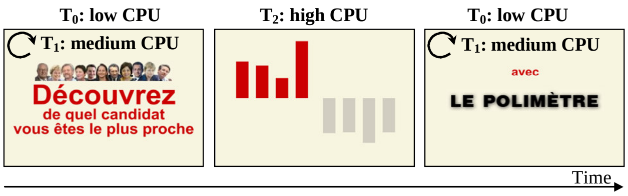

Figure 3. A temporal scalability example

The T_0 layer describes the timing of a simple two-frame slideshow. The T_1 layer introduces transitions between frames such as fading effects and text animations. These extended temporal properties may not be well supported by some radio receivers (e.g. clock-radios) due to low-computing capabilities. Therefore, the T_1 layer should be skipped whenever smooth animations can not be performed. Finally, the T_2 layer inserts graphic animations between the two main frames of the document and targets advanced mobile multimedia receivers by providing them with a complete multimedia experience.

In some circumstances, temporal properties of multimedia documents may have to be disabled. T-DMB car-radio receivers are typical examples since timed presentations are not recommended (or not even allowed) while driving. This specific adaptation need is fulfilled in our Digital Radio demonstrator by skipping all *Temporal* layers of a *Scalable MSTI* document.

3.3 Interactive scalability

The interactivity of multimedia documents constitutes a scalable dimension as illustrated in Figure 4 by providing a progressive user access to media elements. In our Electronic Program Guide (EPG), 7 interactive layers are defined: the first one enables the navigation (if the receiver can handle it) while the other 6 inform about the upcoming programs. This progressive interactivity can reduce the loading time of interactive services and adapt their features to receiver's available memory (cache control).

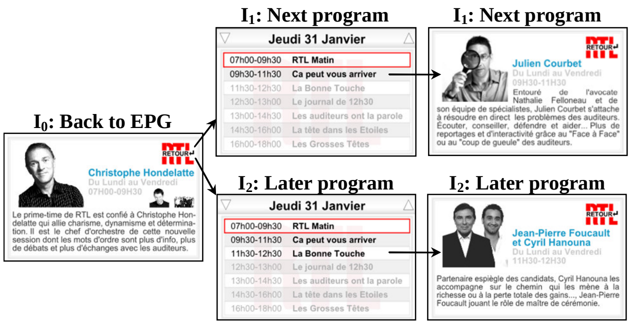

Figure 4. An interactive scalability example

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