Living the TV Revolution: Unite MHP to the Web or Face IDTV Irrelevance!

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ABSTRACT
The union of Interactive Digital TV (IDTV) and Web promotes the development of new interactive multimedia services, enjoyable while watching TV even on the new handheld digital TV receivers. Yet, several design constraints complicate the deployment of this new pattern of services. Indeed, for a suitable presentation on a TV set, Web contents must be structured in such a way that they can be effectively displayed on TV screens via low-end Set Top Boxes (STBs). Moreover, usable interfaces for IDTV platforms are needed which ensure a smooth access to contents. Our claim is that the distribution of Web contents over the IDTV broadcast channels may bring IDTV to a new life. A failure of this attempt may put IDTV on a progressive track towards irrelevance. We propose a system for the distribution of Web contents towards IDTV under the Digital Video Broadcasting – Multimedia Home Platform (DVB-MHP) standard. Our system is able to automatically transcode Web contents and ensure a proper visualization on IDTV. The system is endowed with a client application which permits to easily browse contents on the TV via a remote control. Real assessments have confirmed the effectiveness for such an automatic online service able to reconfigure Web contents for an appropriate distribution and presentation on IDTV.

Categories and Subject Descriptors
J.7 [**Computers in Other Systems**]: Consumer Products

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Keywords: IDTV, MHP, DVB, Web Contents Transcoding.

1. INTRODUCTION
TV and the Web are merging into a unique world. New computer-centered home-entertainment systems (e.g., IPTV) are a confirmation of this trend in which TV contents are distributed over an Internet-based TV infrastructure. While it is widely accepted that TV contents can be delivered through the Internet, yet also the Web can benefit from TV, since Web contents may be distributed over TV broadcast channels. This new opportunity is now made possible with the introduction of *Interactive Digital Television* (IDTV) [5]. IDTV combines traditional TV watching with new interactive digital applications that may be developed to run on the TV. To allow this kind of enhancements, digital applications are broadcast within a TV video stream by broadcasters and retrieved by Set Top Boxes (STBs) that execute them [3, 5]. Not only, IDTV enables also mobile TV. Indeed, the actual approach of streaming TV contents over 3G networks has been recognized to be inefficient when an individual data stream must be associated to each mobile viewer. Rather, new standards based on mobile IDTV have been devised such as DVB-H (Europe), DMB (South Korea and Japan), MediaFLO (America) which broadcast digital signals on TV channels with final performances which seem to be more promising. In this context, bringing the Web to IDTV may represent a great opportunity for IDTV providers and customers. Our claim is that the possibility of distributing Web contents over alternative broadcast channels may bring the IDTV technologies to a new digital life. The huge amount of interactive information stored in the Web represents an important means to inject a new fuel into IDTV. Many experts concur that failing this attempt may put IDTV on a fast track to irrelevance. Nevertheless, an effective technological solution that enables the distribution of Web contents over IDTV has not been found, despite several efforts towards this aim [2, 4, 5]. DVB-HTML has specified how Web pages should be organized to be displayed on a TV set [1]. Yet, opinions about DVB-HTML are widely controversial. Indeed, the actual (HTML-based) Web pages cannot be displayed on TV screens, unless they are re-coded by scratch using DVB-HTML. Moreover, DVB-HTML is regarded as a complex specification, not suitable for devices with poor computational capabilities, e.g., actual STBs and new DVB-H devices [2]. All this makes as emergent the need to devise an alternative transcoding service able to automatically convert (HTML-based) Web contents for display on TV screens. To this aim, we have designed and developed an automatic transcoding system, performing as a gateway between the Web and IDTV, which is able to transcode HTML contents for use on TV screens. The system is endowed with a DVB-J application that performs as a browser on a MHP platform over STBs.

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2. THE WEB MEETS DIGITAL TV
XHTML Basic [6] is a markup language designed for low-end Web clients that do not support the full set of XHTML features, and may represent a viable solution for bringing contents to IDTV devices. We developed a system able to perform an on-the-fly conversion of Web contents into XHTML Basic documents which are in turn easily manageable by STBs, prior to be broadcast over DVB channels. The architecture of our system is comprised of two separate components: i) an automatic IDTV transcoding service able to convert Web contents and to pass them to the broadcaster (for insertion within the carousel); and ii) a DVB-Java (DVB-J) browser application in charge of displaying received

transcoded contents. This DVB-J browser application is broadcast via the carousel and is locally executed on each STB. The transcoding process steps through three different phases. First, HTML contents are transcoded into standard XHTML Basic data; this step simplifies the content management operations at the client side, since well-formed XHTML Basic documents can be easily managed by low-end STBs. In the second phase, tags are removed from standard XHTML Basic documents that cannot be visualized on TV displays. This also produces the additional benefit of reducing document's sizes. Third and final, links to Web objects are managed so as to make them available within an IDTV environment.

2.1 Transcoding Web Contents For IDTV

As previously mentioned, our transcoding service converts automatically HTML pages into data ready to be broadcast over IDTV channels, based on a process whose steps, and side effects, are summarized in Figure 1.

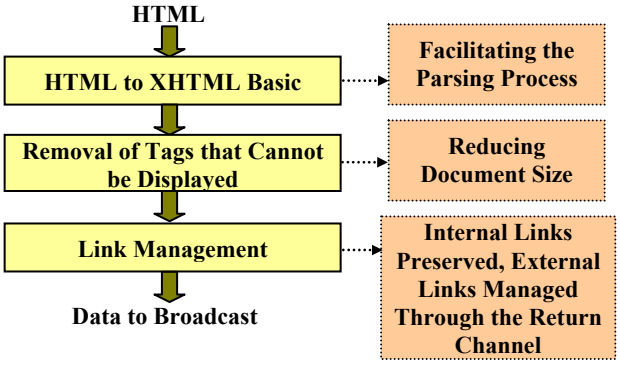

Figure 1. Transcoding Web Contents for IDTV: the Process and Its Effects.

2.2 Browsing on the TV

We have developed a DVB-J application (i.e., a Xlet) that can be broadcast over the carousel to be locally executed on each STB. Since no support over actual MHP systems is provided for XHTML Basic, our Xlet performs as a browser for the XHTML Basic documents produced by our transcoding service. As the focus here is to facilitate human interactions in IDTV settings, our Xlet provides a graphical interface through which typical visualization problems of low-end IDTV devices are fixed as shown in Table 1. Along with typical visualization and usability issues, Table 1 also reports the solutions provided by means of our Xlet.

3. RESULTS AND CONCLUSIONS

We assessed the efficacy of our system using synthetic emulative tools (XletView, OpenMHP) and also resorting to a real DVB-T system, which broadcasts on air contents fetched from the Web (text, images, audio, video), and transcoded on the basis of our system. Figure 2 shows an example of a Web page including an image fetched from the Web (leftmost) and then converted and delivered to a TV screen (rightmost). Finally, it is worth mentioning that our transcoding service typically reduces the size of the Web pages to be broadcast. This is due to the process of removal of tags that cannot be effectively displayed on a TV. Figures about this size reduction are reported in Table 2. In conclusion, we developed a system for the automatic transcoding of Web contents to be delivered on a DVB-MHP platform. Our work confirms that IDTV may avoid irrelevance and unite to the Web by resorting to automatic transcoding services based on the XHTML technology.

Table 1. How the DVB-J Browser Application Works.

Issue	*Solution*
TV set has a low resolution and is watched from a larger distance (w.r.t. a PC monitor)	Larger font sizes are used, Web page to be fragmented over several TV screenshots
Tables can be too large to be displayed on TV	Table are fragmented into subtables
High flickering and visualization problems for (partially sighted) people	When not specified in the document, blue backgrounds and white fonts are employed
A TV remote control has limited input modalities	Scroll bars are replaced by the use of TV remote control to navigate through different screenshots
Positions of links in the screen	Links are moved to separate frame displayed on the top-right side of the screen

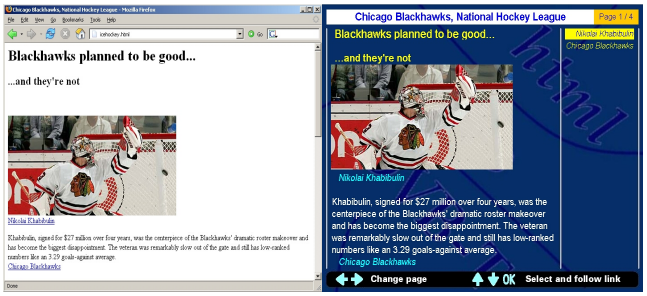

Figure 2. Web Page Visualization on the Web (Leftmost) and on a TV Set (Rightmost).

Table 2. Documents Size Reduction.

Min Value	*Max Value*	*Average Value*
- 4.5 %	- 43.50 %	- 33.07 %

4. ACKNOWLEDGMENTS

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