Accessibility to Digital Society: Interaction for All

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Abstract— **The project HBB4ALL (Hybrid Broadband Broadcasting for All), which has just started, addresses a wide range of interactivity, interoperability and accessibility features for a multi-platform media environment – focusing on the hybrid broadcast-broadband TV (HbbTV) concept.**

Keywords: interoperability, accessibility, connectivity

I. INTRODUCTION

Since access to information was officially declared by the United Nations a Human Right in 2003, much work has been carried out by stakeholders at many levels, but still, media access deployment in Europe is not equitable. Legislation, policy and regulations have been introduced and standards were drafted to assure e-inclusion. The Commission set up a legal framework in 2007 with the "European i2010 initiative on e-Inclusion - to be part of the information society"; this called on the ICT industry to work to help disabled people access digital TV and electronic communications products. It adopted the Audiovisual Media Services Directive in 2010 [1]. However, "content" processes (from conception, production, translation, exchange and archiving to distribution and use) are still complex procedures, both technologically and commercially. All access services (be them for the elderly or for people with disabilities) are language dependent. To turn the accessibility vision into reality, the active participation of multiple stakeholders is required in the value chain. HBB4ALL will address all relevant stakeholders and all components of the value chain.

One of the prominent challenges of the coming years will be the multi-platform delivery of audio-visual content (anytime, anywhere, any device) [2], be it a broadcast or a (future) Internet (IP) TV service. Hybrid delivery platforms such as connected TVs and two-screen solutions will be ubiquitous. One aim is to automate, to the extent possible, the production of access services. Subtitling accounts for 0.2-0.5% of production budgets in large countries and up to 1% in small countries. While subtitles do not demand large data-rates for their transmission or retrieval audio description (AD) and audio subtitles (inter-lingual subtitles) are more cost-incentive and require somewhat higher data rates. Offering visual signing is most demanding in terms of bandwidth and production costs whilst - on the other hand- the target audience is relatively small. So, the other aim must be to balance the provision of access services to audio visual content

between broadcast delivery (satellite, cable and terrestrial networks) and Internet (IP) delivery. At the same time, care has to be taken of new technological possibilities offering new or improved access services for the end user. Everyone who needs a specific service should be able to use it and, to the extent possible, and customize it to his or her personal needs.

The HBB4ALL project builds on HbbTV, as the major European standard, for converged services and looks at both the production and service sides. HbbTV 1.x devices are widely available in the market while HbbTV version 2.0 is currently under development. HbbTV provides a straight-forward specification on how to combine broadcast and broadband content plus interactive applications. TV content can be enhanced with additional synchronised services in a personalised manner. For access services this opens an entirely new opportunity for users who may choose an access service delivered via their IP connection which then seamlessly integrates with the regular broadcast programme.

The project will identify improvements to existing access services and ways of addressing the key technical, organisational and legal obstacles to the sustainable take-up of these services throughout Europe. Both quality and quantity metrics will be addressed in a user-centric approach. The project will offer new insights from the fields of human machine interaction and social innovation, given the fact that a new interactive multimodal and multilanguage service will be offered. This paper will first describe the structure chosen for the project, with four pilots developed in parallel. Then, it will describe the methodology and research approaches for the tests regarding quality benchmarking and measurements.

II. METHODOLOGY

The project is divided in four pilots. They will take place in a synchronic way, in the 36 months during the life of the project. Pilot 1 deals with Multi-Platform Subtitle Services. Across Europe, broadcasters are working to provide subtitles on multiple platforms for individuals who are deaf and hard-of-hearing, or do not have sufficient language skills to understand the content without textual support either in the original or foreign languages. The main challenge is to provide subtitles tailored to the specific needs of the end-users in terms of channels, platforms and consumption requirements. This requires a well-conceived production and distribution strategy that allows for the exchange of subtitles and their automatic re-purposing producing quality and impact-driven access

services for multiple platforms. This pilot is a thematically clustered and cross-country, and is driven by three major factors:

- In a converged world there is a demand for distributing subtitles through additional output channels while economic pressure prevails.
- New technological options, fostered by the market penetration of IP-based services and of HbbTV as successful open standard for Connected and Hybrid TVs – allowing for improved individual rendering of subtitles through customisation by the user.
- Technology has matured to allow for automated generation of subtitles which benefits broadcasters through cost reduction and productivity increase and viewers through an increase of subtitled programmes on offer.

One of the new channels to be served by subtitles are VoD (Video on Demand), services which have become increasingly popular, given the growing penetration of HbbTV which has led to a multitude of catch up TV portals throughout Europe. Using the example of HbbTV such a service is technologically possible but simply not available up to now on connected TVs. For the current (2013) generation (version 1.*) of HbbTV-enabled devices there is no standardised implementation of features for a synchronisation of video with other data streams. Here, service providers need to implement JavaScript mechanisms requiring considerable processing power in the TV-device. Ultimately, this might lead to interoperability problems. The worst case scenario is that it would influence overall device behaviour. In HBB4ALL new and updated mechanisms for synchronising video and subtitles within an HbbTV-based player will be analysed and chosen for integration.

A new trend is the automatic multilingual generation of subtitles. Real-time subtitling through automatic speech recognition and subtitle machine translation into other languages is starting to be employed to support professional multilingual subtitling and increase its productivity. Although the quality of the automatically generated subtitles is still far from professional without manual post-edition, subtitling automation functionalities could be very useful and desirable in a wide range of applications within the HbbTV paradigm. This pilot will make available advanced HbbTV automatic multilingual subtitling functionalities, building up on technology currently under development in the European SME-DCL SAVAS [3] and CIP-PSP SUMAT [4] projects. Its application will be tested in a newsroom use-case scenario where the feasibility of automatically generating multilingual subtitles of real-time news relevant at international level.

Pilot 2 deals with alternative audio production and distribution. Given EU citizen mobility, TV content is not only seen by nationals, but also by large communities living away from home. There is also a need to broadcast same content in different languages synchronically (e.g., Swiss TV or Brussels TV) but the content is not the same across languages. Hence, having different languages for one programme is one of the major aims of the project. DVB (Digital Video Broadcasting) has the technical requirements for playing different audio tracks synchronised with one broadcast video. This is being done already e.g. for additional audio description or dual-language provision at ARTE TV channel or the Catalan TV3.

Since the upcoming specification of HbbTV 2.0 will offer a solution for synchronized IP and DVB reception, additional audio tracks can be also transmitted via IP to save bandwidth in the broadcast channel. This feature offers several possibilities within the scope of HBB4ALL. Transmitting additional language streams with HbbTV 2.0 is one of the testing opportunities this pilot is aiming. Especially for hearing-impaired people the dialog intelligibility of TV audio signals is a key criterion. Due to various reasons, the intelligibility of current TV audio mixes is often assessed as insufficient by users, including elderly, non-native speakers as well as hearing-impaired people. Investigations of the UN show a continuous increasing average age in Europe for the next decades [5], so the percentage of hearing-impaired people will consequently also increase. Hence, another major objective of this pilot is to enhance the dialogue intelligibility, as it would be beneficial for these groups. HBB4ALL will offer users the possibility to adjust the dialogue intelligibility to personal preference and will transmit clean audio enhanced streams by exploiting HbbTV 2.0 features. For Web-only TV services such as VoD, more sophisticated personalised solutions will be demonstrated since modern browsers offer the full set of HTML5 functionalities. A third group benefiting from this pilot is people with vision disabilities. A common practice is to support these groups broadcasting an extra audio channel using DVB-T (Digital Video Broadcasting Terrestrial) facilities. The AD channel contains a description of the action mixed with the dialogue. This technique allows vision impaired users to follow what is going on in a far more effective way than by hearing the dialogue alone.

Pilot 3 looks at automatic User Interaction (UI) adaptation and smart TV applications. During the last years digital TV as a media platform has increasingly turned from a simple receiver and presenter of broadcast signals to an interactive and personalised media terminal with access to traditional broadcast as well as web-based services. Actual TVs (Connected TV, Smart TV) already turn the TV into an application platform and service terminal. At the same time it is recognised that some user groups like elderly people with different kind of impairments still face problems when using those services. Approximately half of the elderly people over 55 suffer from some kind of functional limitations (vision, hearing, motor and/or cognitive). For these users, interaction, especially with PCs or other consumer electronics devices, is sometimes challenging. Often people have problems to connect their TV to the Internet, not to mention the barriers raised by digital menus and EPGs (Electronic Programme Guide). However, accessible ICT applications, e.g for social media, education, health monitoring, telemedicine, etc., could make a difference for their living quality. They

have the potential to enable or simplify participation and inclusion in their surrounding private and professional communities. The Digital TV industry is following different approaches for the deployment of such services. On one hand, there is HbbTV as a standardised application platform, which provides means to host broadcast channel oriented content and application services. On the other hand, most Smart TV manufacturers maintain their own proprietary application environments (e.g. app stores, middleware) on the device, as it is the case for Google Android or SAMSUNG's Connected TV. These environments are often available in addition to broadcast and HbbTV services. Service providers that aim to target the elderly society using those application platforms would benefit largely from a solution that enables accessibility for such services. However, the availability of accessible or customised user interfaces, being capable to adapt to the specific needs and requirements of users with individual impairments is nowadays still very limited. There are numerous APIs available for various operating systems or application platforms (e.g. in Web browsers) that allow developers to provide accessibility features within their applications. Further there are of course many assistive devices and technologies available, especially for people with specific impairments (e.g. brail code rendering, screen readers, eye tracking, etc.). The key issue is that none of them offers features for automatic adaptation (and personalisation) of user interfaces. Moreover, the provision of accessible user interfaces is still expensive and risky for application developers, as they need special experience and effort for user tests. Many implementations simply neglect the needs of elderly people locking out a large portion of their potential users. The aim of this third pilot is to provide a web-based service that would allow the personalisation and adaptation of user interfaces for Connected TV services running on HbbTV 2.0 based platforms. The accessibility features of such a service will make use of the UI adaptation framework that was developed within the European project GUIDE (Gentle user interfaces for elderly people) [6]. GUIDE provides an open source software framework as well as design tools that support Smart TV service providers in efficiently integrating accessibility and personalisation features into their services considering especially the needs of elderly users with mild impairments, with features for HTML5 such as the adaptation of font sizes and colour schemes. The targeted web-service will include functions for user management and profiling, a standard application that allows user testing and profile initialisation based on different accessibility tests as well as a UI adaptation service that gives feedback and recommendations to the SmartTV application how to adapt the UI rendering according to the need of the individual user. Service providers will be capable to easily include those UI adaptation features into their services using the API of the GUIDE framework.

The last pilot is that related to sign language translation. Visual signing for audio visual media such as film and television was shown for the first time in 1929 as a means to make such content accessible to individuals whose mother tongue is a sign language and not an oral language. Users of sign language are often born deaf. In many European countries, there are constitutional and legal provisions to assure the provision of sign language for such citizens who, in numerical terms, account for less than 1% of the population.

Over the last 3 decades, broadcasters have moved from a single platform (analogue terrestrial broadcasting) to multi-platform digital distribution. Signing on analogue TV has traditionally been an open service, with the sign language interpreter being located either in a small window at the bottom of the screen or on the right-hand side of a the screen, as shown in the photos in Figures 1 and 2.

Fig 1. Signing on RTP1, Portugal

Fig 2. Signing on RTBF, Belgium

User studies reported in the EU project DTV4ALL document [7] that the RTP solution (fig. 1) with the interpreter in a small window is not optimal, as the picture-in-picture does not contain enough detail. Viewers of sign language prefer solutions like the one used by RTBF (fig. 2) and many other broadcasters. Existing television audience research suggests that, with the noticeable exception of television in Portugal (where RTP has more than 4,000 hours of signing annually, also in prime-time), viewers who do not use sign language interpreting on TV often object to 'open signing' (the inclusion of a sign language interpreter in the television picture for all viewers). While it is possible to offer a second channel, or a second video stream, with signing in the digital broadcast either as a fully-formatted video signal or as a 'widget' overlay, these are expensive as it requires additional transmission bandwidth –a least 2 megabit/second. Internet or integrated broadcasting (to the main TV screen or to a Second Screen) are thus cost-effective delivery options for closed signing (optional) services. For example, Sweden's TV4 has been delivering sign language interpretation via the internet since late 2011. On modern TV sets that also have an Internet browser, viewers can select this option on their TV sets. German public service broadcasters have

been looking to use HbbTV as a delivery mechanism for sign language interpretation. In the first instance, a fully-formatted channel including the interpreter can be delivered via the Internet. The current release of HbbTV already supports this option, which would rarely call for more than 2-3,000 simultaneous streams in a given area covered by the broadcast signal. In the medium to long term, the aim is to use HbbTV 2.0 (which contains a good synchronization mechanism) to handle the presentation of a widget that is overlaid on top of the existing broadcast signal delivered via DVB, if the terminal hardware is supporting the parallel decoding of two video streams. There are correlations to captioning/subtitling, in that the HbbTV option would allow for a greater degree of viewer customization (determining the size and position of the interpreter on the screen).

Broadcasters dependent on advertising express concerns that an obligation to offer signing would lead to a noticeable reduction in advertising revenue, since audiences dislike screen contamination with the interpreter. Offering closed signing (where the viewer can choose to see or not to see the interpreter) requires much more bandwidth than closed subtitles or audio description. Signing is important not only for mainstream programming and TV programming specifically for the signing communities in Europe and elsewhere but also emergency alerts on TV. Citizens need to be informed of risks of natural or man-made emergencies and told what action they should take. This issue is underscored in the forthcoming guidelines for signatories of the UN Convention on the Rights of Persons with Disabilities that specifically mentions metrics for television targeting deaf communities.

Discussions on the Digital Dividend (the use to which radio frequency spectrum could be put following the transition from analogue transmission to more efficient, digital technologies) have not lead to bandwidth allocations in digital terrestrial broadcasting earmarked for signing. A solution to this challenge is becoming urgent, as the regulatory pressure to offer signing increases while bandwidth in broadcast networks becomes ever more costly.

III.   EXPECTED RESULTS

Being an ETSI standard, HbbTV is currently linked with the DVB TV system family but can, in principle, be used in conjunction with any digital TV service in the world. DVB is widely used throughout all continents. Sooner or later, all countries in the world will have completed their analogue-to-digital switch-over. As a consequence, the results of HBB4ALL will be of worldwide relevance and will, through standardisation bodies such as the ITU and ISO, also be publicised on a world-wide level. Given the impact in close fields such as eHealth and eEducation, for example, the results from this project will have important results and direct impact. On its basis, HBB4ALL is elaborating pertinent guidelines, guides of good practice, metrics, and recommendations and will initiate campaigns to promote the project results, and thus raise awareness not only on the necessity of

access and interaction services but also on the technical solutions available with interoperability. For that purpose, all relevant stakeholders, from content providers to user associations, will be addressed.

IV.   CONCLUSION

The overall objective of HBB4ALL is to become a major platform/player in the e-Inclusion economy currently taking place, fostering the future market take-up of exiting innovations in conceiving universal accessibility tools and concepts to satisfy the diverse interests of all societal groups.

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