NoTube

Networks and ontologies for the transformation and unification of broadcasting and the Internet

FP7 – 231761

NoTube and HbbTV
- An Analysis -

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EXECUTIVE SUMMARY

Hybrid Broadcast Broadband TV (HbbTV) is a pan-European initiative that aims at complementing the delivery of broadcast content to the consumers via broadband. This involves, similar to NoTube, both broadcast and online services. In this report we identify the similarities and the differences of HbbTV and NoTube. We examine to which extent the use cases in NoTube could be realised following the HbbTV standard and conclude that this is possible to a certain degree.

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Abstract (for dissemination)	In this report we identify the similarities and the differences of HbbTV and NoTube.
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1. Scope

The purpose of this document is to clarify the relation of NoTube [1] and Hybrid Broadcast Broadband TV (HbbTV) [2]. The focus is to investigate to which extent the NoTube Use Case scenarios could be realised with HbbTV.

2. Introduction

The number of households with broadband access to the Internet has significantly increased in the past decade. This leads to an increased consumption of audio-visual content via the Web. New scenarios and business models emerged and more and more broadcasters started to provide textual but also audio-visual content on their websites in addition to linear broadcasting (radio and TV).

Nevertheless, up to now there are no open standards that provide means for seamless merging of the TV and the Web. For this reason, projects such as NoTube and initiatives like HbbTV try to answer both the content providers' and the end user's needs.

3. About NoTube

NoTube is a three-year EU-funded research project about the future of TV, based on use cases around personalisation and social networking. The project started in March 2009 and is conducted by an international consortium.

As part of the wider trend of TV and Web convergence, the project aims to demonstrate how Semantic Web technologies can be used as a tool to connect TV content and the Web through Linked Open Data. By specifying protocols and APIs to support a variety of realistic user scenarios for experiencing future TV, NoTube offers a novel contribution to the TV media world.

Semantic technologies are a field of standards and technologies which allow a machine-understandable and machine-processable representation of the meaning of digital content, which, in turn, can be used to create more intelligent, responsive and personalised applications. In NoTube we apply these technologies for two main purposes:

- Semantic annotation: in the media and television area semantic annotations can enable new types of application which know or do anticipate what users want and what programmes describe, so that we can build more intelligent services.
- User interests from the Social Web: knowledge extractable from a person's TV viewing activity and Social Web presence (on Twitter, Facebook etc.) can enable a semantic application to implicitly determine their interests, and match them to TV programmes.

The work in the project is steered by the following three use cases.

3.1. Personalised semantic news

This use case targets the delivery of personalised news services. Guided mainly by speech-to-text, news programs are segmented into news items and enriched by text metadata relating to names, places, topics, or generic concepts. These are matched to, and filtered by, user preferences and delivered via alerts (in the case of breaking news), an automatically generated local news channel, or by user-initiated search.

Showcase goals:

- To exploit the flexible/adaptive end-to-end architecture developed in NoTube

- To verify the actual feasibility of a system for the creation and the delivery of a set of local personalised news services based on the repurposing and enrichment of news item material already transmitted over generic broadcast streams
- NoTube will also use the built demonstrators and pilots to analyse, both from the point of view of the service provider and the final user, new personalised services and new models of interactive programmes, initially news-oriented, outside the regular programming.

3.2. *Personalised TV guide with adaptive advertising*

This use case focuses on personalised EPG[1] services and advertising, adapted to context (such as time and location) and the control interface of different devices.

Showcase goals:

- Design and implementation of multilingual personalised programme guide (PPG) across multiple devices (Web, iPhone, connected TV and set-top box)
- Personal ad placement based on user profiling and state-of-the-art metadata classification
- To develop a clear advertisement model for personalised ads
- Support for multiple languages (including Turkish, Korean and Dutch) including translation of EPG metadata
- Providing users with multiple modes of interfacing with a system, for example, combining a visual modality (e.g. display and keyboard) with voice modality (e.g. speech for input)

3.3. *TV and the Social Web*

This use case is about technologies that can help people interact with each other while watching TV – whether with people on the Web or in the same room. It aims to demonstrate APIs for linking the Social Web with broadcast and on-demand television by using linked data from broadcasters, audiences and across the web, to help make social content navigation applications and active TV communities.

4. About HbbTV

Hybrid Broadcast Broadband TV (HbbTV) is a pan-European initiative aiming at complementing the broadcast delivery to the end-user via an additional broadband connection (typically via DSL) to TV sets ("Connected TVs") and set-top boxes (STBs). The HbbTV specification was developed to manage the increasing amount of available content targeted at today's end consumer. It is based on elements of existing standards and web technologies including those developed by OIPF [3], CEA [4], DVB [5] and W3C [6]. HbbTV was standardised by ETSI in June 2010 [7].

Figure 1: HbbTV Logo

According to the HbbTV Consortium, HbbTV products and services will "provide the consumer with a seamless entertainment experience with the combined richness of broadcast and broadband. This entertainment experience will be delivered with the simplicity of one remote control, on one screen and with the ease of use of television that we are used to. Through the adoption of HbbTV, consumers will be able to access new services from entertainment providers such as broadcasters, online

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[1] Electronic Program Guide

providers and also CE manufactures including catch-up TV, video on demand (VoD), interactive advertising, personalisation, voting, games and social networking as well as programme-related services such as digital text and EPGs."

4.1. How HbbTV works

HbbTV does not depend on a particular broadcast link or on a particular IP link. It may be applicable with either the one or the other connection, but of course it gains most momentum in a connected environment where both broadcast and broadband are available. Important components used in HbbTV are taken from CE-HTML, the OIPF DAE specification and the DVB Application Signalling Specification to define the application languages, the formats and embedding of audio-visual content, application signalling and transport etc.

From a broadcaster's perspective, HbbTV provides, similar to teletext, additional content to a TV broadcast which can be displayed on the TV screen if the user wants to. This is realized using dedicated signalling in the digital broadcast signal (DVB); content is delivered over the air like teletext, or over the Internet (see Figure 2). To use the full spectrum of services, the users need to connect their TV set or STB to the Internet. HbbTV devices are equipped with an Ethernet interface and/or allow for a WLAN connection to the Internet. A CE-HMTL browser is integrated that allows displaying the additional content which is provided in XHTML format.

Many TV sets or STBs are nowadays already capable of displaying content through integrated HTML browsers. They are able to connect to a device manufacturer's portal, where the content is managed or selected by the manufacturer, at the push of a button on the remote control, and also allow the access to general web content in the Internet. HbbTV-compliant devices have the ability to detect application signalling and to extract content (web pages) from the broadcast to run HbbTV services.

Figure 2: Basic HbbTV Scenario (source: [2])

From a user point of view, the connection of the TV programme with additional service-related content is realised through HbbTV applications. An HbbTV application can generally be accessed using the red button of the remote control when watching a TV programme ("red button function"). The application can be displayed in a layer on top of the current television picture (see Figure 3). From here, the user can typically choose from different functionalities offered by the application just by using the remote control, e.g. more information about the current programme, a programme guide, Catch-up TV etc. It is to be noted that access is possible to the additional information provided by all broadcasters that cooperate in an HbbTV service[2]. This includes the access to the public archives or

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[2] An example for broadcasters cooperating in HbbTV is the German ARD, where eleven public service broadcasters provide joint access to their HbbTV applications and their public TV, radio and web archives. The collection of their programmes is called ARD bouquet.

Catch-up TV (in Germany called "Mediatheken") of cooperating broadcasters - independent from the programme currently selected by a viewer.

Figure 3: Digital TV image with overlaid HbbTV Application (ARD start page)

The data of the application itself can both be provided in the DVB data carousel signal or via the Internet. Typically, data for applications that are frequently used are transmitted within the DVB signal. Additional data is then retrieved from the providers' (usually the broadcasters') servers using the Interaction Channel. In principle, all HbbTV data including images can be transmitted using the broadcast stream. However, in reality, the line is drawn somewhere in between in order to balance the performance of the applications and the load of the provider's servers.

End devices need to support the following formats according to the HbbTV specification:

- MPEG-4 AVC (Advanced Video Coding) and AAC (Advanced Audio Coding) for video and audio essence in MPEG-4 file format or MPEG-2 transport stream. Dolby Surround audio is included in markets where it is mandatory for broadcast services.
- XHTML 1.0, CSS TV profile, ECMA script for document structures and document data

In Germany, HbbTV services are currently available from all major broadcasters in connection with their digital broadcasts via satellite and TV cable. HbbTV devices for DVB-S have been available since early 2010; devices for DVB-C and DVB-T have followed by end of 2010 / beginning of 2011. As soon as there will be a significant number of DVB-T devices in the market, capable of HbbTV, DVB-T will also be upgraded to carry the necessary links. HbbTV would fit perfectly with managed IPTV networks; negotiations with IPTV operators are ongoing. France also decided to introduce HbbTV and other European countries are developing HbbTV test services, too.

In addition, there are HbbTV applications that are not connected to a broadcast stream. Such applications can typically be found on manufacturers' portals or within other HbbTV applications e.g. advertisement. Since these portals are so-called "walled gardens", i.e. they are controlled by the manufacturer or the content provider, third-party providers need to negotiate the placement of their applications. However, on some devices the users can also add HbbTV applications at their option.

In the future, the HbbTV specification should be extended to support additional features such as the time synchronisation of IP and broadcast content as well as improved profiling, personalisation and recommendation for hybrid services.

5. The common ground of HbbTV and NoTube

Both HbbTV and NoTube are aiming at combining television and the web and both approaches share common objectives. One aspect of HbbTV is on enabling broadcasters to provide additional services using the Internet and to combine these services with the linear programme. This means a lot of HbbTV applications are programme-related and broadcast-centric. Regarding the possibility of realising the NoTube Use cases with existing HbbTV technology, this leads to certain constraints since the NoTube scenarios are focussing on cross-service applications.

However, HbbTV takes also care for applications which are not related to broadcast services. These applications are known as broadcast independent applications, kind of 3rd party applications which do not necessarily belong to the device manufacturer or to a broadcaster. Such applications have restricted access to broadcast resources, e.g. they are allowed to tune to a DVB service but they cannot include the service as part of the application. As a result of this policy, the application is stopped once it tunes to a service. The HbbTV specification is silent about how a 3rd party application enters a device, but, in principle, this can happen via a manufacturer portal or by a URL entered by a user.

5.1. Personalised News

Within a broadcast service, the personalization of news could be realized with HbbTV using cookies on the TV set or the STB. These cookies can store a user profile or user identification. For example, an HbbTV application could suggest news items which are provided by the programme provider on his web pages following previous selections (i.e. viewing habits) or user preferences. Nevertheless, the regular linear broadcast programme would be the entry point for such an application.

The first version of HbbTV does not encompass a concept to share user preferences on a terminal level, but it is possible to share user IDs and preferences among cooperating service providers. What is called a broadcast related HbbTV application is always part of a broadcast service or of multiple broadcast services provided by cooperating broadcasters; it is not a terminal application. Terminal applications may be implemented using the same browser and APIs, but this is outside of the HbbTV specification.

Another possible solution for personalization of broadcast content could be the use of the PVR[3] functionalities provided by HbbTV. HbbTV allows to add a broadcast event to the terminal's timer list and to play recordings which have been initiated by the application provider. However, a fine-grained reassembling of previously broadcasted news items to form a personalized news show as it is foreseen in NoTube is hard to realize since start and end points of a recording are usually not identified at frame level and depend on the PVR implementation of the device. Nevertheless, a personalization of recordings on a coarser level, e.g. 45-mins documentaries, could be imaginable.

5.2. Personalised TV guide with adaptive advertising

A personalized TV guide could also be realized in HbbTV. Applications can store information on devices by means of cookies. The application can either store the profile in the cookie or just a user identifier with the actual user profile being stored on the server side. A current prototype of the ARD[4] providing such a feature was launched at IFA 2010 (see Figure 4). However, some constraints apply:

- Cookies are always tied to an Internet domain, i.e. a personalized TV guide in HbbTV would be limited to the programme of one service provider or a cooperation of service providers (e.g. the ARD bouquet), but would not work generally across several services of non-cooperating service providers.

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[3] Personal Video Recorder
[4] Arbeitsgemeinschaft der öffentlich-rechtlichen Rundfunkanstalten der Bundesrepublik Deutschland (Consortium of the public-service broadcasting institutions of the Federal Republic of Germany)

- Further personalization considering an individual personal profile is only possible using IDs that need to be exchanged between the HbbTV application on the end user's device and the user profile which is created and managed by the user via the provider's web application (e.g. http://programm.ard.de). The IDs need to be manually entered in the HbbTV application to link the application with the profile.

Figure 4: Screenshot of ARD's redesigned EPG with "like"-function

Personalized ads or even programme trailers could be presented to the user in commercial breaks or other programme slots of the linear programme. This can be realized using the AIT[5] information within the DVB Transport Stream to signal and start an HbbTV application with adapted ads and/or trailers during the break. At the end of the slot, the application would continue to play the linear broadcast stream and terminate itself. Besides, cross-service TV guides could be provided by manufacturer portals or gateways, e.g. EPGs derived from DVB-SI data together with enriched data from the web. However, HbbTV allows only access to EIT[6] present/following.

5.3. Internet TV in the social web

HbbTV allows to provide social functionalities in the sense that, for example, links are provided to web pages where programme related discussions take place. Today, broadcasters support communities of specific TV programmes (e.g. of soap operas) by providing a pertinent Web Portal. HbbTV provides a platform to access such portals directly from the TV, e.g. while the show is on air.

Of course, broadcast independent applications can be used to provide HbbTV versions of popular websites like Facebook, Twitter, etc on TV. However, as already mentioned, access to broadcast resources via third party applications, which are not controlled by the device manufacturer or by a broadcaster, is limited to tuning to a TV service.

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[5] Application Information Table
[6] Event Information Table

6. Connecting HbbTV and NoTube

Two possible scenarios of connecting NoTube with HbbTV can currently be identified, namely the use of HbbTV content in the NoTube platform or, vice versa, the use of NoTube content on HbbTV devices. Both scenarios are investigated in the following sections.

6.1. HbbTV content in NoTube

Using HbbTV content in NoTube could happen in two ways. Firstly, the NoTube platform could be extended for being HbbTV compliant and provide a complete HbbTV experience. This would require tuners for DVB-S, -C and/or -T in addition to the Internet connection. Secondly, NoTube enrichment services could potentially exploit HbbTV services from service providers. These are provided free to air, so they could be received and exploited by anyone. However, the AIT in the DVB signal contains only the URLs to the HbbTV applications. The application itself can also be contained in the DVB signal, but only with limited content due to the limitations for additional data services predetermined by the multiplex assembler. Applications that are transmitted via IP can be quite substantial. They could also contain URLs to videos, e.g. related content in catch-up TV platforms or trailers, but it is doubtful if the parsing of these web pages can be done in a way that results in meaningful information, i.e. correct linking of content and metadata. This is due to the fact that video URLs in the DVB signal are not standardised.

6.2. NoTube content in HbbTV

By means of HbbTV, a programme provider can add additional information to the unidirectional broadcast signal. This additional information can be presented directly to the user and furthermore provide access to additional (non-broadcast) content using the HbbTV mechanism of the DVB stream, i.e. using URLs to access websites where additional content is located. Such additional information and content are always provided and controlled by the broadcaster. NoTube, in contrary, aims at cross-service recommendations i.e. content from different content providers which is linked according to the user's personal profile. Furthermore, NoTube would not have the possibility to include HbbTV information to a broadcast from another (non-cooperating) provider.

Thus, the NoTube services as they are envisaged now, e.g. the recommendation service, are not likely to be useful for HbbTV. However, it would generally be possible to use the NoTube service mechanisms, e.g. for broadcasters who provide several channels (similar to ARD's EPG application as an example for the use of a recommender).

Another possibility would be the provision of NoTube recommendations in a broadcast-independent "NoTube HbbTV Application". These applications are typically listed in portals of device manufacturers. Some of these portals are walled gardens, i.e. applications are only on display after negotiation with manufacturers, but some are open and allow the end user to add any HbbTV application. But such an application would be stopped once it tunes to a DVB service.

7. Conclusion

HbbTV and NoTube share similar objectives. The use case scenarios which are in focus of NoTube could technically also be realised with HbbTV. However, in contrary to a lot of available HbbTV applications today, which are clearly broadcast-centric and programme-related, NoTube aims at providing general solutions across all electronic media services. HbbTV applications require negotiations with all service providers involved.

Nevertheless, the technologies developed in NoTube might result in broadcast-centric or programme-related applications suitable for HbbTV. Besides, more and more broadcast-independent HbbTV applications are available, too.

8. References

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