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Where Content Comes to Life

Terrestrial 4K-UHDTV Experimental Broadcasting in Korea

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Abstract

The term UHDTV derives from the dimension of its video of which horizontal and vertical resolution are two-fold or four--fold of those of HDTV. Therefore, UHDTV is classified into 4K--UHDTV(3840x2160) and 8KUHDTV(7680x4320) according to screen resolution. UHDTV delivers the sense of presence with ultra high definition video, immensely wide field of view, and multichannel audio. Furthermore, UHDTV can also support the frame rate of 120fps, wider color gamut, color-depth of 12 bits, and 22.2-channel audio to represent the sense of reality to the utmost faithfulness. Due to the fact that UHDTV has huge amounts of data, it is commonly misunderstood that the 6MHz band-width of terrestrial broadcast can't meet the requirements of UHDTV. In Korea, KBS carried out terrestrial 4K-UHDTV experimental broadcasting from October 9, 2012 to December 31, 2012. The most prominent feature of this experiment is that it is the first UHDTV broadcasting via a terrestrial TV channel. To overcome many technological limitations, we exploited cutting-edge technologies like HEVC(High Efficiency Video Coding) codec and DVB-T2 transmission and reception system. HEVC is the next-generation compression method being standardized by JCT-VC. In this paper, we'll explain the details of KBS' 4K-UHDTV experimental broadcasting. The explanation will be given in a step by step manner according to the order of 4K-UHDTV content acquisition, 4K-UHDTV content compression with HEVC codec, DVBT2 transmission and reception, HEVC real-time decoder of this trial broadcasting.

INTRODUCTION

In Korea, on December 31, 2012, the termination of analog terrestrial broadcasting was succeeded by complete changeover to digital terrestrial broadcasting, HDTV. HDTV is no longer a new technology to the general public because its 10 years of presence has made it too ordinary for our viewers to feel any newness. Moreover, TV viewers are starting to request for a post-HDTV broadcasting service and many market participants are responding to the request rapidly.

Now, UHDTV, together with 3DTV, is one of the highly anticipated ruler in the post-HDTV era. UHDTV refers to the television having four times or sixteen times as many pixels, 3840x2160 or 7680x4320, as that of HDTV[1].

Unlike 3DTV which gives realism by binocular disparity, UHDTV covers a large part of viewers' field of view and the resultant wide viewing angle presents the sense of presence. For the faithful rendition of reality, UHDTV technology goes beyond the simple multiplication of the screen size. In other words, everything is better in UHDTV. For example, frame rate of 120Hz and progressive scan contribute to depicting clear images of fast moving objects, 12 bits of color-depth vivifies the subjects, and 22.2ch audio puts you in the middle of the site's sound field[1]. The sum of all these is vast video/audio data and new technologies to deal with it must be developed and standardized.

The research about UHDTV was first conceived by NHK(Japan Broadcasting Corp) in the name of SHV(Super Hi-Vision) in 1995 targeting the post-HDTV broadcasting system. After years and years of research about UHDTV, significant progress of UHDTV systems, for example, camera, display, transmission, video coding, etc, have been made enabling 8K UHDTV production and intercontinental IP transmission of 2012 London Olympics by NHK and BBC.

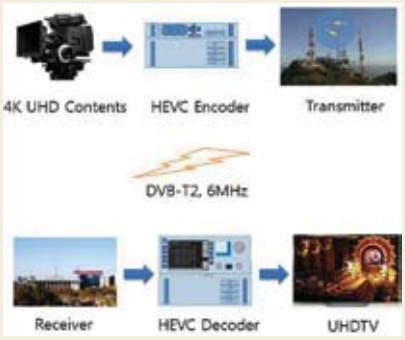

FIG 1 KBS' TERRESTRIAL 4K-UHD EXPERIMENTAL BROADCASTING

In Korea, KBS conducted the world's first terrestrial 4K-UHDTV experimental broadcast from October 9, 2012 to December 31, 2012 employing DVB-T2 and HEVC technology. The outline of the experimental broadcast is depicted in FIG 1.

In the following sections, details of KBS' test broadcast will be explained in a categorized manner. The first is about UHDTV video format, the second is about acquiring, editing, post-processing of UHDTV contents, the third is about HEVC encoding of UHDTV contents and the generation of its TS stream, the fourth is about DVB-T2 transmission system, and the last is about the receiver and HEVC decoder.

UHDTV VIDEO FORMAT

UHDTV video and audio signal formats are partially standardized and some parts of them still remain undecided. Therefore, opportunities are still open for everyone. As said, UHDTV video format includes 4K (3,840×2,160) and 8K (7,680×4,320) resolution. Related standards are ITU-R BT.2020(UHDTV parameters), BT.1201-1(video resolution),

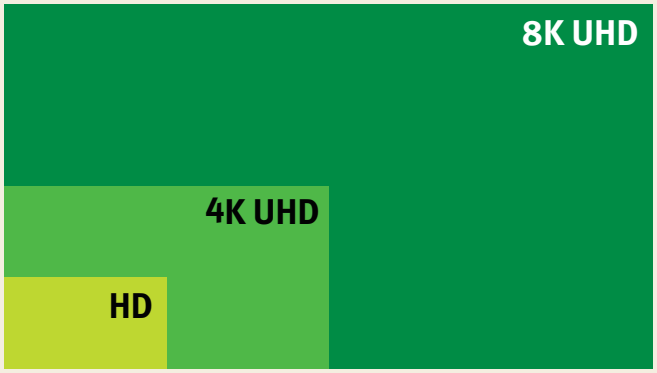

FIG 2 RESOLUTION AND SCREEN SIZE

TABLE 1 UHDTV VIDEO STANDARD

	UHDTV		HDTV
	4K	8K	
Pixels	3840x2160	7680x4320	1920x1080
Frame Rate	24p, 25p, 30p, 50p, 60p, 120p		60i
Pixel Depth	10, 12bits		8, 10bits
Sampling	4:4:4, 4:2:2, 4:2:0		4:2:0
Aspect Ratio	16:9		16:9
Audio Channels	10.1~22.2ch		Stereo, 5.1ch
Field of View	55 °	100 °	30 °
Viewing Distance	1.5H	0.75H	3H
	H : the height of the screen		

BT.1361(colorimetry), SMPTE 2036-1(video signal), and SMPTE 2036-2(audio signal). TABLE 1 is the summary of UHDTV video standards(the selected parameters in this experimental broadcast are written in red.) and TABLE 2 is the UHDTV video data amount according to varying parameters[6].

As seen in the tables, the UHDTV standard includes various bits per pixel, chroma sampling, and scanning methods. Therefore, the amount of data needed can be varied from fourfold to 16-fold of HDTV depending on parameter compositions. FIG 2 compares the size of the display devices having the same pixel size according to their resolutions.

Due to the limitations imposed by the gap between the idealistic UHDTV specification and the current level of possible UHDTV implementation, we chose to adopt 4K, 30p, YUV 4:2:0, 8bits(color-depth), HEVC encoded video and stereo audio to put UHDTV contents within 6MHz bandwidth of current terrestrial digital broadcasting. The use of YUV 4:2:0 and color-depth of 8bits is due to the limitation imposed by HEVC main profile.

MAKING UHDTV CONTENTS

For this experimental broadcasting,UHDTV content was an essential prerequisite. Therefore, the first step was to prepare 4K-UHDTV content.

TABLE 2 UHDTV VIDEO DATA AMOUNT

	Frame Rate	Chroma Sampling & Color Depth	Data Amount (Gbps)
HD	30	Y/CbCr 4:2:2 10bits	1.16
4K	30	Y/CbCr 4:2:2 10bits Y/CbCr 4:2:2 12bits RGB 4:4:4 10bits RGB 4:4:4 12bits	4.63 5.56 6.95 8.34
	60	Y/CbCr 4:2:2 10bits Y/CbCr 4:2:2 12bits RGB 4:4:4 10bits RGB 4:4:4 12bits	9.27 11.12 13.90 16.69
8K	60	Y/CbCr 4:2:2 10bits Y/CbCr 4:2:2 12bits RGB 4:4:4 10bits RGB 4:4:4 12bits	37.08 44.49 55.62 66.74

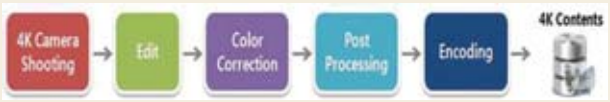

FIG 3 KBS' 4K CONTENT PRODUCTION PROCESS

TABLE 3 KBS' 4K CONTENT PRODUCTION PROCESS IN DETAIL

Step	Particulars
Acquisition	Camera : RED EPIC Video Format : 5120x2700, 23.976p Compression : RED RAW
Editing	Tool : Adobe Premiere CS6 Output : Apple Prores 422 (HQ) 3840x2160, 29.97p
Color Correction	Tool : Pablo Input : Apple ProRes 422 (HQ), 3840x2160, 29.97p Output : Apple Quicktime Animation Codec, 3840x2160, 29.97p
Encoding	Tool : Apple Compressor Input : Apple Quicktime Animation Codec, 3840x2160, 29.97p Output : Apple ProRes 422 (HQ), 3840x2160, 29.97p
Post Processing	Image Enhancement Input : Apple ProRes 422 (HQ), 3840x2160, 29.97p Output : BMP 3840x2160
Encoding	HEVC Input : YUV 4:2:0 8bits

The process of making 4K-UHDTV content includes video acquisition, recording, editing, post-processing, and encoding of 4K videos. In case of the 4K-video acquisition, there are not many 4K cameras for broadcast purposes but several kinds of digital cinema cameras like

RED, Sony F series, etc are available in the market. These 4K digital cinema cameras are now used widely in TV drama production in Korea by the benefit of their excellent color, shallow depth of field, convenience of high speed shooting. KBS owns several 4K digital cinema cameras and shot several spectacular action dramas with them. Though these dramas were converted to and aired in HD, the original 4K files remained untouched and we chose to fill some part of our test broadcast channel with them.

But there were two big shortcomings of 4K digital cinema cameras when they were applied to broadcast content production workflow. First, there was no 4K content creation process built up in KBS. Second, digital cinema cameras simply stored images without any processing whereas most TV cameras had inside image processing units. This makes it necessary to apply post-processing to videos from digital cinema cameras.

After studying these problems, we found appropriate countermeasures and established a probationary 4K content creation process in FIG 3 and its details are listed in TABLE 3.

HEVC COMPRESSION OF A 4K VIDEO AND CREATING A MPEG-2 TS(TRANSPORT STREAM)

To deliver 4K content to the destination via a terrestrial channel within a 6MHz bandwidth, HEVC compression technology having more than 4 times higher compression ratio than MPEG-2 is essential[3][4]. HEVC is now under the standardization process led by JCT-VC. JCT-VC is the abbreviation of 'Joint Collaborative Team on Video Coding' and it was established by MPEG of ISO/IEC and VCEG of ITU-T in 2010 aiming at developing a next generation codec having more than twice the performance of H.264/AVC. The standardization process of HEVC is scheduled to be completed in 2013 and it is considered to be the strongest contender for UHDTV codec.

TABLE 4 ENCODER DETAILS

Video Codec	HEVC (HM 6.0)
Input Video	Size : 4K(3840x2160) Sampling : YUV 4:2:0 Color Depth : 8bits Frame Rate : 30fps
Encoder Setting	Main Profile Maximum CU size : 64x64 Intra Period : 32 GOP Size : 8
Rate Control	Not Available *Manually adjusted negotiating picture quality and bit rate. Quantization parameters used : 28, 30, 32, 34, ……
Bit Rate	30Mbps

KBS is participating in a government-run R&D project for developing a real-time HEVC encoder and decoder in concurrence with ETRI (Electronics and Telecommunications Research Institute) and Kai media Co., Ltd. and has applied the resultant decoder to the world's first terrestrial UHDTV experimental broadcast.

As seen in TABLE 3, the final outcome of the UHD content creation process is DPX images and AC3 audio files. To make a MPEG-2 TS file suitable for experimental broadcast, we first split the entire image sequences into 5 minute slices, converted the images into an YUV 4:2:0 30p file, encoded them using HM(HEVC Model) 6.0 standard S/W encoder with the parameters shown in TABLE 4 and multiplexed the encoded video with the AC3 audio file. TABLE 5 compares the amount of data needed to deliver 4K UHD contents.

TABLE 5 CODECS AND 4K-UHD DATA VOLUME

Compression Methods	4:4:4	4:2:2	4:2:0
MPEG-2	260 Mbps	195 Mbps	130 Mbps
H.264	130 Mbps	98 Mbps	65 Mbps
HEVC	65 Mbps	49 Mbps	32.5 Mbps

(FRAME RATE: 60P, PIXEL DEPTH: 10BITS, DATA RATE: 4K = HD X 10)

4K-UHDTV TRANSMISSION AND RECEPTION

TABLE 6 COMPARISON BETWEEN DVB-T AND DVB-T2

	DVB-T	**DVB-T2**
Error Correction Code	Convolutional Coding & Solomon Code	LDPC & BCH
Coding Rate	1/2, 2/3, 3/4, 5/6, 7/8	1/2, 3/5, 2/3, 3/4, 4/5, 5/6
Interleaving	Bit/Frequency	Bit/Cell/Time/Frequency
Modulation	QPSK, 16QAM, 64QAM	QPSK, 16QAM, 64QAM, 256QAM
Guard Interval	1/32, 1/16, 1/8, 1/4	1/128, 1/32, 1/16, 19/256, 1/8, 19/128, 1/4
FFT Size	2K, 8K	1K, 2K, 4K, 8K, 16K, 32K
Scattered Pilots	8% of total	1%, 2%, 4%, 8% of total
Continual Pilots	2.6% of total	0.35% of total

The transmission system employed is DVB-T2, the European digital terrestrial transmission system. DVB-T2, when compared with DVB-T, has significantly improved transmission capacity and efficiency. TABLE 6 compares DVB-T2 with DVB-T[5].

KBS was granted Ch.66(center frequency: 785Mhz, output power: 100W) by KCC(Korea Communications Commission) for terrestrial 4K-UHD experimental broadcast and the signal

was aired from Mt. Gwanak's KBS transmitting station. The signal from Mt. Gwanak's transmitting station was received by an antenna on the top of one of KBS' buildings. The received signal was demodulated and recovered to MPEG-2 TS stream to be fed into 4K-UHD real-time decoding system.

4K-UHDTV DECODER

FIG 4 REAL-TIME HEVC SOFTWARE DECODER

The 4K-UHD real-time decoding system was the outcome of the collaboration of KBS, ETRI, Kai Media Co., Ltd. under the government-run R&D project commissioned by KCC. The decoding system is equipped with a software type HEVC decoder capable of decoding 4K 30p video in realtime and outputs the decoded video through one HDMI 1.4 or 4 DVIs. The basis of this HEVC decoder is HM 6.0 but we recomposed it with lots of fast algorithms and parallelized processing. For the next terrestrial 4K-UHD test broadcast, we have a plan to upgrade this decoding system to support 60p 4K video.

CONCLUSION

UHDTV and 3DTV seem to be the most prominent axes of the post-HDTV era. They are the same in aiming for delivering the sense of presence and the sense of realness but different in their approaches to achieve the goal.

As everyone knows, 3DTV relies on binocular disparity to render 3D. In this case, perfect alignment of left and right eye images is essential. But there is no easy and excellent solution for this perfect alignment. Therefore, significant technological advancements must happen first and it seems that it would take some time. On the other hand, UHDTV seems to be a simple problem compared to 3DTV, though not easy. Furthermore, content production cost is estimated to be less than that of 3DTV while providing a significant degree of the sense of realism.

This relatively low technological difficulty of UHDTV made the broadcast industry of Korea move promptly toward it. Now, 4K displays are rushing to the market in search for a new source of revenue and KBS, as the public broadcaster responsible for establishing the foundation of the future broadcasting for the good of national and public wealth, has a strong willingness to carry forward terrestrial UHDTV broadcasting experiments in a bid for the invigoration of UHDTV broadcasting.

To clarify this willingness, KBS is working on another 4K--UHDTV(60p) experimental broadcast this year. After the completion of this experiment, KBS will ceaselessly devote its best effort to fulfill the aspiration of starting 4KUHDTV broadcast in 2018 and 8K-UHDTV experimental broadcast from the beginning of the Pyungchang 2018 Winter Olympic Games.

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HbbTV – Status and Prospects

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Abstract

HbbTV (hybrid broadcast broadband TV) is an openly standardized technology platform for OTT services on ConnectedTVs and SmartTVs, respectively. HbbTV brings the broadcast and the broadband world seamlessly together. Published by ETSI in summer 2010 it was quickly adopted by European markets. Broadcasters can significantly benefit from the technology as it allows them to create a holistic service experience with the broadcast service as the anchor, while providing also on-demand and individually useable service elements via broadband. The benefits HbbTV provides also to manufacturers, service providers (network operators) and other content providers like App developers contributes certainly to the success of HbbTV. The technology platform receives growing interest worldwide. With the kick-off of the development process for a v2 version, HbbTV aims to address the needs of rapidly evolving markets.

BACKGROUND

The idea of connecting a TV set to a communication network is everything but new. With the upcoming data terminals in the 80th the concept of connecting a TV set to the data network appeared to enable individual services for the viewers. The market implementation failed.

It can be seen as an example that several elements must fit together to bring technical concepts to live in the market. In the context of "interactive TV" there is the high resolution and large flat screen. It can display graphics and UI with high quality, readable from the distant sitting in a sofa. There is also the experience of consumers with on-demand services both via service providers but also on the PC. And there is a rapidly growing availability and bandwidth of broadband connections to the homes.

At that point TV sets appeared with connection to the Internet, so called "connected TVs", bringing Internet services, known and used by consumers to the TV screen. Although there is a large range of applications media centric services are at the heart. Since then the market has rapidly evolved making "SmartTVs" a dominant type of TV sets.

DESIGN PARADIGM OF HBBTV

Already in the late 90th organizations around the world started standardization processes for "interactive TV". With some local exceptions the market impact of these standards on TV-sets was limited. So the questions frequently pops up: why do we need a standard? Is there a benefit? As a basic principle, a standard must address immediate market needs and provide benefits to all market players of the eco-system covered by the standard.

This was the driving paradigm behind the HbbTV initiative created out of 2 national initiatives in France and Germany in 2009. The core aim is to seamlessly bring the broadcast environment and the internet environment together for the TV. For that HbbTV specifies an openly standardized business-model neutral technology platform. Only minimum requirements are specified. This has various effects. It speeds up the creation of the specification and simplifies implementations. At the same time it leaves room for market participants, in particular manufacturers to differentiate. Quite important, it is applicable to all kinds of broadcast and broadband networks.

From a broadcast perspective, there are some important elements included. So, there is the possibility to use the technology also within a broadcast only reception environment. A broadband link is not mandatory. Also, the broadcast channel can serve as the anchor to complementary service elements. Utilizing an integrated application management the system maintains the integrity of broadcast services. Also, only the terminal behavior is specified.

It is very important to note that HbbTV is an openly standardized business-neutral technology platform (Fig 1). It does not specify an entire ecosystem but leaves room for market participants to leverage it for its particular business.

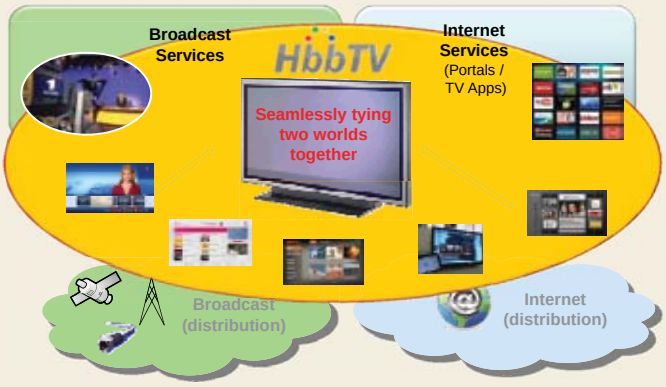

FIG 1: HBBTV SEAMLESSLY COMBINES BROADAST AND BROADBAND

TECHNICAL SOLUTION

Which technical elements are needed? HbbTV started its development from key mature and stable pieces of technology. Where necessary, elements from other work were mixed in. In order to limit complexity and as not all features of other solutions are relevant for the design objectives, HbbTV choose to profile other technical elements as needed.

On the broadcast side a key ingredient is the signaling of additional applications in the broadcast stream. DVB had long time ago already specified a mechanism called "application information table". A small adaption, described in a DVB blue book was sufficient to make it work for HbbTV. Another key element is the data carousel in the broadcast link. DVB had specified the DSM-CC mechanism which is used also by HbbTV. This enables to provide supplementary data also via broadcast. Finally, the application life cycle manager is essential to, for instance, ensure the service integrity. This mechanism was already known, e.g. from the GEM (MHP) specification.

On the Internet side the core is the browser specification based on CE-HTML. However, a lot of additional elements are needed for an "Internet Environment" on a TV set. As HbbTV has its roots also in the "Open IPTV-Forum" (OIPF), the "declarative application environment (DAE)" of OIPF became the technical basis which provides the interaction between TV and HTML. For instance a player integration and control for the TV signal is essential – besides a specification of the supported media formats. Additional elements coming from this environment into HbbTV are the support for java scripting and hooks for content and service protection. However, HbbTV does not specify a particular CA / DRM system.

Since the initial specification additional market requirements came up. So an improved version of the specification was developed. The most important is the support of MPEGDASH. By this HbbTV today supports not only adaptive streaming but also an advanced DRM integration.

MARKET SITUATION

In summer 2010 ETSI published the HbbTV specification as TS 102 796 v1.1.1. In parallel some markets started the adoption of the new standard, namely France and Germany. Today, a large number of European countries have HbbTV in operation or conduct trials and have announced the launch of services (Fig.2).

Most services today are provided by broadcasters. Broadcasters have early on identified the potential of the new specification for their services. In Germany more than 90% of the broadcast market1 operates HbbTV applications. Interestingly not only the big channels have adopted it but also numerous small, local and niche channels make use of it to guide consumers to their additional online offerings. The key argument is that this specification allows broadcasters to maintain control of their entire service offering. The broadcast channel remains the anchor of the service and by the application signaling (today instantiated by the "red button"), the consumers can be guided seamlessly in the ondemand Internet-oriented services like catchup-TV, VoD, etc. There is no need to place these offerings on portals of 1 In terms of market share. manufacturers and negotiate the placement, license conditions, and adapt it for the specific technology of manufacturer portals. Practically all manufacturers support HbbTV in their SmartTVs, quite a few in their entire range of TVs. HbbTV has become a common feature of SmartTVs. But also a growing number of STBs are supporting HbbTV, not only in the premium segment but also in the main stream high volume segments. Estimates claim about 5-6 Mio HbbTV-compatible devices in the German market by end of 2012. Around 60% of them are connected. The usage rate shows a rapid growth with same broadcasters publish figures beyond 1 Mio users just for their own services.

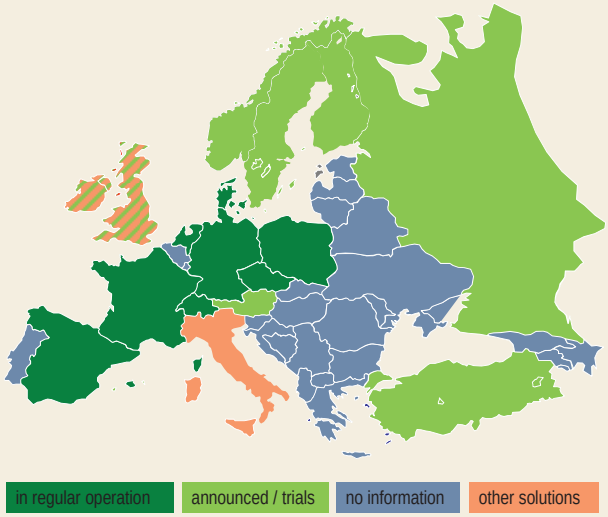

FIG 2: MARKET IMPLEMENTATION OF HBBTV IN EUROPE

While large manufacturers have their own software technology for the TVsets and STBs, some smaller manufacturers leverage HbbTV also to build their entire device portals. HbbTV is also the basis of service provider portals, like HD+ SmartTV of SES ASTRA and Eutelsat Kabelkiosk (portal for cable networks).

Quite encouraging for the HbbTV initiative is the interest it receives outside Europe. In particular in the Asian region several countries have a thorough look at it and prepare for trial. Also ATSC 2.0 shares a lot of similarities with HbbTV. In November 2012 ETSI published with TS 102 796 v1.2.1 a new HbbTV specification, with support of MPEG-Dash and enhanced DRM support being the key extensions of the original

FIG 3: RED BUTTON SIGNALING THE AVAILABILITY OF ADDITIONAL PROGRAM RELATED INFORMATION TO THE CONSUMER

specification. As these technical elements were developed due to high market demand and clear benefits operational services are expected soon.

APPLICATIONS

Broadcast services are much more than just an AV stream. Broadcast services create a holistic user experience. For that broadcast services combine broadcast elements and broadband service elements.

The “red button” concept became common as notification to consumers that new services are available.

Note, that this button is essentially a WEB-page providing fully flexibility to the broadcaster in design, position and size. It may even vary over time. Once the consumer presses the button, the market participants converged on a behavior, where a new “WEB-Site” brings up a broadcast service owned portal page with all the additional services from that particular broadcast channel.

FIG 4: A BROADCAST SERVICE CONTROLLED PORTAL PAGE ALLOWS EASY NAVIGATION TO APPLICATIONS PROVIDED BY THAT PARTICULAR BROADCAST CHANNEL

The navigation by left and right cursor keys is very straightforward and can even be simplified by means of the color keys guiding consumer directly to some selected applications.

As the underlying technology is a browser, supported by java scripting and a player control, a plethora of services can be realized. The broadcasters have started to experiment with these opportunities. There are services which let the consumer select from various live video sources, which could be WEB-cams as well as additional live video streams from sport events. Also a portal has been realized to provide access to very small local broadcast station, which would normally hardly be found in an EPG with hundreds of stations. As several of these small stations even do not have 24/7 broadcasting, it enables a 24/7 access via seamless redirecting from the portal to either broadcast link or the internet stream.

Commercial broadcasters experiment with enhanced advertising. Video text is very popular in Germany. Using HbbTV for new video text services allows to make ads in the video text clickable. There are also shopping channels utilizing HbbTV to present detailed information about advertised products upon user request and eventually offering to purchase the products (Fig.5).

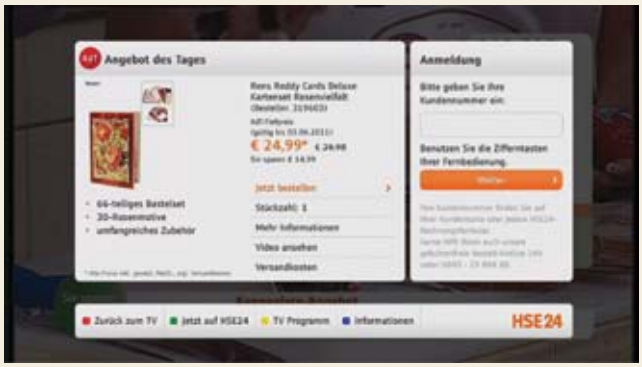

FIG 5: HBBTV-BASED PRODUCT INFORMATION OF A SHOPPING CHANNEL

First applications have already been developed which integrate social communities like facebook and twitter in parallel to the program.

In particular public service broadcasters have the obligation to create and provide barrier-free services for handicapped people. It includes improved readability of WEB-pages, closed captions, signer etc. Based on HbbTV such services can easily be realized. Even more important, every viewer can individually choose make use of it without the need for simultaneous broadcast of normal and barrier-free services.

FIG 6: INDIVIDUALLY CONFIGURABLE WEB-PAGES TO IMPROVE READABILITY DEPENDING ON PERSONAL ABILITIES

A topic with very high attention is the discussion around the 2nd screen. Studies confirm high usage rate of smartphones tablets and alike in parallel to the TV screen. From a content providers perspective the key interest is to leverage the 2nd screen for improving the service experience. So, it must be integrated into the service experience. Based on a standard HbbTV compliant device (TV set or STB) and a normal tablet or smartphone without a specific application installed a technical solution was developed where the broadcaster can address each device with individual program related content. As a prerequisite the consumer needs to pair the devices, which is done by means of QR-codes.

As a result, one could watch TV show while additional information is presented on the 2nd screen. One can also select VoD-content on the 2nd screen while the video is played on the main screen. A particular characteristic of such kind of solution is that it runs on every standard HbbTV device without modifications or manually downloading additional applications.

FIG 7: INDIVIDUALLY CONFIGURABLE WEB-PAGES TO IMPROVE READABILITY DEPENDING ON PERSONAL ABILITIES

Concluding, “One plus one is much more than two” could be the headline describing the potential of HbbTV for application developers.

When speaking of applications the range of applications independent of broadcasters has to be mentioned as well. First of all, there exist applications from content providers other than broadcasters. These, so called “unbound applications” are primarily media centric. As already mentioned, HbbTV is also suitable to build portals. There exist solutions from several service providers for different kinds of networks covering cable, satellite, and digital terrestrial.

FIG 8: EXAMPLE OF A SERVICE PROVIDER PORTAL BASED ON HBBTV WHAT IS NEXT?

The development of HbbTV does not stop. The development speed in the Internet is high and to keep HbbTV as technology-platform attractive and competitive in a converging market it must evolve as well. The challenge however, is, that HbbTV is at the intersection of two entirely different worlds. The broadcast domain tends to move on a slower pace than the Internet world. Consumers are (so far) less frequently updating their TV-set than their mobile phone. The Internet, however, develops at a rather fast track. So, besides the technical issues the market situation has to carefully taken into account. How to deal with a large legacy base of consumers not willing / able to replace devices in a short period of time?

From a technical perspective “hot spots” are certainly support of HTML5 and support of 2nd screens – among others. The process of identifying issues to be included in a new standard has started.

SUMMARY

After many, many years seeing various developments for the convergence of broadcast and the Internet it seems that now is the time where it eventually happens. Manufacturers have developed their individual solutions for SmartTVs. The HbbTV specification, with the first version published by ETSI in summer 2010, brings the broadcast and the broadband (“Internet”) worlds seamlessly together. It is an openly standardized and business-neutral technology platform. HbbTV was adopted in a short period of time in the various European markets.

The range of applications is barely exploited yet, as the combination of service elements from both the broadcast and the broadband worlds unleash a tremendous potential. HbbTV is determined to continue to address this potential benefiting the entire ecosystem.