STANDARDS FOR OTT:
Bringing order to chaos
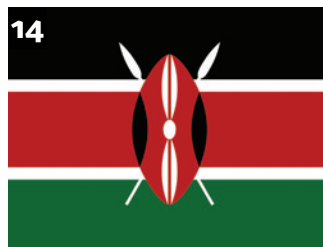
CONTENTS

Bringing standards-based order to OTT

Over its lifetime, DVB has seen its core specifications for broadcast delivery evolve from "rising star" to "mature solution" – and a highly successful solution at that. Services based on DVB standards for broadcast typically serve as cash cows for the industry. By definition, cash cows are mature and stable solutions that can be operated with minimal investment. The resulting profits can be reinvested in the development of new solutions, to find the next rising star.

For example, many users of DVB specifications use broadcast-related profits to subsidize OTT delivery. DVB has not ignored this trend. While maintaining our mature broadcast standards, the main focus is now on OTT delivery, through DVB-I and associated specifications, and applications like targeted advertising.

These are domains where services based on proprietary technology, or a mishmash of solutions, already exist; DVB wants to bring standards-based order to this rather chaotic landscape.

The fact that DVB has welcomed 20 new Members over the last 18 months clearly shows that this is the right strategy. These companies have joined DVB because they want to participate in the development of new services and applications.

With this new direction DVB has also moved to adapt its way of working. Our technology is moving up the protocol stack, from the physical layer (typically implemented in hardware) to the transport and application layer (implemented in software). V&V (verification and validation), compliance and conformance testing have become integral parts of our

Peter Siebert
Head of Technology, DVB Project

specification development process. Also, our already close relationship with HbbTV is becoming even closer. I would even go so far as to predict that in the future most of our specifications will be developed in cooperation with HbbTV. One day technologies like DVB-I will be the industry's cash cow and DVB – naturally – will be working on the next rising star.

"THESE ARE DOMAINS WHERE SERVICES BASED ON PROPRIETARY TECHNOLOGY, OR A MISHMASH OF SOLUTIONS, ALREADY EXIST; DVB WANTS TO BRING STANDARDS-BASED ORDER TO THIS RATHER CHAOTIC LANDSCAPE."

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DVB News

INFOGRAPHIC PUBLISHED

Comparing ATSC 3.0 with DVB-T2

PHYSICAL LAYER	**Both systems use the same basic technologies.** Some new options in ATSC 3.0 offer slightly improved performance.	
TRANSPORT LAYER	**ATSC 3.0 uses an IP-based transport layer, while DVB-T2 relies on the MPEG-2 Transport Stream.** DVB has also defined an encapsulation scheme for using IP on DVB-T2.	
CONTENT PROTECTION	**DVB's Conditional Access specifications underpin the majority of the world's broadcast pay-TV services.** The Digital Rights Management system specified in ATSC 3.0 uses W3C Common Encryption protocol (CENC), with some additions to allow broadcast-only implementations.	
VIDEO CODECS	**Both ATSC 3.0 and DVB-T2 specify the use of HEVC video coding; DVB-T2 also provides the option of MPEG-4/H.264.** Having a choice of codecs allows DVB-T2 implementers to strike a balance between coding efficiency, licensing costs, etc.	
INTERACTIVE SERVICES	**ATSC 3.0 specifies an HTML5-based approach to interactive services; DVB-T2 works optimally with HbbTV.** There is a well-established ecosystem of HbbTV apps and devices as well as a comprehensive conformance regime.	
COMPLETE ECOSYSTEM	**DVB has specified a family of standards to deliver digital television over satellite, cable, terrestrial and IP networks.** By covering all interfaces – from signal source to the end user – across all platforms, DVB enables valuable synergies.	
GLOBAL DEPLOYMENT	**DVB-T2 is on air in more than 90 countries; ATSC 3.0 services have launched South Korea and there are trial services in some US markets.** Over 1 billion DVB receivers worldwide are served by a rich and diverse marketplace of professional equipment.	

Icons from the Noun Project: Fatahillah, artworkbean, Ed Piel, Bambaleg, Garrett Knoll, Aenhan Kirisik, Hare Krishna

DVB Project Office | August 2019 | dvb@dvb.org

The publication and subsequent promotion of the ATSC 3.0 standards for terrestrial broadcasting prompted several requests to DVB for information about how the new system 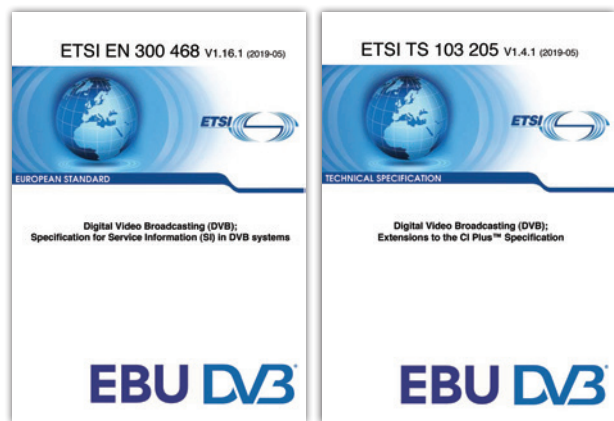compares to DVB's solutions. As a result, the DVB Project Office put together an infographic that provides a brief overview of the relevant similarities and differences.
See: www.dvb.org/atsc3

NEW FROM ETSI

ETSI TS 103 205 V1.4.1: DVB extensions to the CI Plus™ specification (May 2019)

ETSI EN 300 468 V1.16.1: Specification for Service Information (SI) in DVB systems (August 2019)

NEW MEMBERS

Digital UK, owned by Arqiva, BBC, Channel 4 and ITV, leads the development of Freeview, the UK's most widely used television platform. www.digitaluk.co.uk

EASii IC is an ASIC design house, an electronic design centre and a service company in microelectronic, electronic and embedded software. www.easii-ic.com

InterDigital works on innovation relevant to 5G and other key technologies, such as edge computing and standards-based machine-to-machine communications. www.interdigital.com

Kineton is an engineering company that assists clients in the creation and development of products and solutions in the media, ICT, telecoms and automotive sectors. www.kineton.it

Mytech International Co., Ltd., under the brand MYWELL, provides DVB-based products and solutions to pay-TV providers worldwide.

netgem.tv has a product portfolio that brings together smart devices and content to enable personalized TV experiences. www.netgem.tv

Synamedia helps service providers around the globe to deliver, protect and monetize content with an end-to-end open video delivery solution. www.synamedia.com

WideNorth is a research and technology company currently developing a high end DVB-S2X compatible wide-band satellite modem. www.widenorth.com

Is DVB 5G ready?

Doesn't everyone have to be 5G ready? It's a question that was posed at a Steering Board meeting a year ago, and that has led to ongoing work in the area. The resulting Study Mission Group should deliver its report in October 2019, with recommendations on what DVB should do on this hot topic.

3GPP is the global entity that standardizes mobile telecommunications technologies. It works in "releases" with a new one coming approximately every 12 to 18 months. For marketing purposes, a new brand – such as 3G, 4G, 5G, etc – is announced from time to time. The first release in the 5G family was Release 15 (published in June 2019), to be followed by Release 16 in 2020. Each 3GPP release includes some 1,200 individual technical specifications. 5G is a huge body of work.

MEDIA VERTICAL
What's unusual about 5G is that it represents the first mobile telecommunications technology to embrace other "verticals" than the telecoms stakeholders in its development process. Automotive, medical and media organizations were encouraged to feed requirements into the 5G development work and to follow this through, to ensure that the resulting specifications met the requirements of that particular industry segment. A prime example of this is the EBU's embracing of the 5G challenge by introducing broadcaster-friendly requirements into the process. Release 14 demonstrated that a vertical can influence a technology development process as complex as that of 3GPP. It includes broadcaster-friendly features such as free-to-air reception and techniques to facilitate operation with high-tower high-power networks. DVB's focus now centres around

understanding the 5G process and identifying opportunities where DVB's specification activities could be useful to that process. DVB-I is set to provide a simple user experience for consumers with OTT and hybrid devices; as 5G is an access technology, DVB-I could be useful to 3GPP. Likewise, DVB's distribution technologies are best of breed for their networks and could be useful complements to other 5G access networks.

Influencing a technology development process brings significant challenges though. As some of the 5G specifications are designed to meet requirements other than core mobile telecommunications, the onus on proving the commercial viability of those features falls upon the proponents. Unlike previous generations of mobile telecommunications standards, there is no guarantee that all the features in the 5G specifications will make it into products without such justifications.

DVB'S ROLE
But 5G is relentless. Its popularity in governmental and regulatory circles knows no bounds. Each and every organization that is engaged in the delivery of bits needs to have a position on 5G. Having such a position helps place this important technology in a wider context and draws favour from the powers that be.

Will 5G replace DVB-T2 in DTT

Peter MacAvock
Chair, DVB Project

services? No. Will it be an important technology for the delivery of media services to mobile devices? Yes; just as 4G is today. What could a media service look like on 5G? Could DVB play a role in how such a service is defined? These and many other questions need to be addressed. Guided by the Steering Board and the trusted DVB process, we will deploy a combination of work inside the project, liaisons with appropriate external bodies such as 3GPP, and engagement with stakeholders that sit across the different bodies to ensure that we have the best set of measures possible for the industry.

DVB'S FOCUS NOW CENTRES AROUND UNDERSTANDING THE 5G PROCESS AND IDENTIFYING OPPORTUNITIES WHERE DVB'S SPECIFICATION ACTIVITIES COULD BE USEFUL TO THAT PROCESS.

Peter MacAvock is the Chair of the DVB Project. He has been Head of Delivery Platforms and Services in the EBU Technology & Innovation Department since 2008. He was Executive Director of DVB from 1994 to 2008.

ITUWRC
SHARM EL-SHEIKH 2019

28 October – 22 November
Sharm El-Sheikh, Egypt

WRC-19 and the importance of what's *not* on the agenda

Despite the growth of IPTV and OTT services, satellite and terrestrial networks remain today the preferred delivery platforms for audiences. Their existence relies greatly on the availability of the frequencies they use to deliver digital television services. But spectrum is a limited resource that needs to be carefully managed and coordinated to ensure all wireless services have appropriate access. That is why this year's major event for the spectrum management community, the World Radiocommunications Conference 2019 (WRC-19), is so important.

Organized every four years by the International Telecommunications Union (ITU), the WRC revises the Radio Regulations, an international treaty governing the use of spectrum. The treaty includes the decisions, recommendations and procedural rules necessary for the international coordination of spectrum. It also has a table of frequency allocations indicating for each frequency range (from 8.3 kHz to 275 GHz) which wireless services are allowed in each of the three world regions: Europe and Africa (Region 1); the Americas (Region 2); and Asia and Oceania (Region 3).

SETTING THE AGENDA
One key agenda item for WRC-19 is spectrum for 5G in the bands above 24 GHz. This does not seem to concern the broadcast industry, which mainly uses frequencies below that range. However, broadcasters will be concerned by the definition at WRC-19 of agenda items to be discussed at WRC-23.

A preliminary agenda for WRC-23 contains proposals to review the use of the UHF band 470-960 MHz. The core digital terrestrial television (DTT) band (470-862 MHz) has already been reduced by the allocation to mobile services of the 800 MHz band (790-862 MHz, known as the first digital dividend) and the 700 MHz band (694-790 MHz, second digital dividend). The remaining part, the 470-694 MHz band, is crucial for DTT in most European countries and WRC-23 will need to find flexible solutions to allow for other uses in certain countries while remaining compatible with DTT. The way the preliminary agenda is currently defined provides enough flexibility for different outcomes; the broadcast community needs to ensure that European countries at WRC-19 resist any attempt to bring the discussion forward to WRC-19 or to change the scope of WRC-23.

Another concern for the broadcast industry might be the push from certain countries and the mobile industry to add a WRC-23 agenda item seeking allocation to the mobile services, for 5G, of those parts of the C-band downlink (3.4-4.2 GHz) not allocated yet. C-band is critical for satellite services in tropical regions as it suffers less from the attenuation effects of heavy rainfall than higher frequency bands and is essential for international broadcasting services across the world.

The EBU will represent its members' interests at the WRC-19 and defend the retention of these bands for the delivery of digital television services.

WHO ATTENDS & WHY?

The ITU has 193 member states, which are represented at a WRC by a delegation from their respective national governmental agency responsible for the use of the spectrum. They aim to ensure an adequate share of interference-free spectrum for each service as per their national requirements.

The sector members of the ITU are over 800 private-sector entities and academic institutions (e.g. mobile industry, broadcasters, satellite operators, CE manufacturers, radio astronomy, space agencies, radio amateurs, aeronautical industry, etc.). Each aims to ensure the service they represent has access to as much as spectrum as required, that their services are not interfered with by other services, and that they are not technically constrained due to the protection of other services. Considered as observers, sector members need to influence member states, who take the final decisions.

Elena Puigrefagut is a senior project manager at the EBU. She coordinates joint technical activities undertaken by EBU members on frequency planning and spectrum management and regulation and, in particular, frequency planning studies for terrestrial broadcasting systems.

Specifying the DVB-I Service Layer

Over the last 35 years the internet as a whole has evolved to become a reliable and significant delivery mechanism for information, communication and entertainment in both the enterprise and consumer domains. At the same time, social media, subscription-based movie platforms and video sharing services have both driven and taken advantage of the technical innovation of the internet while increasing consumers' comfort and familiarity with the wide range of experiences made available.

LACK OF SPECIFICATIONS

Traditional broadcasters and new media companies have, with differing levels of success, used the internet to initiate direct-to-consumer services for catch-up programming, and in some cases live events, to expand their consumer base into new territories, to offer niche content that would not merit dedicated delivery systems, and to maintain their relationship with the viewer. One of the difficulties in developing these systems has been the lack of well-defined interoperability specifications between the service and the terminal, requiring each provider to invest in the development of client platforms and applications.

DVB aims to solve the interoperability issue, along with the problem of service discovery, through its DVB-I initiative to develop an internet-based transport system for linear TV services. The internet knows no geographical boundaries and DVB-I will allow programming to be distributed on a global level, while still honouring any necessary licensing agreements or regulatory requirements.

The DVB-I Service Layer provides the mechanism for a client, which could be an application running in a smart TV set or other form of consumer electronic device, to discover service lists that represent a curation of linear services as well as access data and associated programming information. The discovery process will make use of generally known approaches such as well-known host or service names.

Service lists have the ability to convey a multitude of descriptive items regarding the list itself and the services being represented, including any geographic preferences and presentation ordering. The DVB-I service list builds on work previously done by DVB to develop service lists for IPTV and for the augmentation of scanned channels. It is also possible to designate a list of services as representing the official channel line-up for a specific region or geographic area.

The overall intent of the DVB-I activity is to provide a television-like integration and experience for services that use an internet delivery mechanism, while ensuring that the same service lists can be used with other viewing devices such as mobile phones and tablets.

SEAMLESS INTEGRATION

In addition to providing the above mechanism for the discovery of services, DVB-I will define programme metadata that can be used to construct an electronic programme guide. This metadata builds on the data model used in TV-Anytime and the CDN cache-friendly data requests used in the Freeview Play solution.

It is expected that a DVB-I client will be able to offer an experience that seamlessly integrates traditional broadcast techniques (satellite, terrestrial and cable) with low latency IP streaming enabled through the DVB-DASH specification (DVB BlueBook A168, see page 10) while maintaining support for regional programming and interactive applications.

In developing an internet-centric solution for linear television services, DVB anticipates a future where traditional broadcasting can be enjoyed by viewers who only have access to the internet.

DVB-I system components
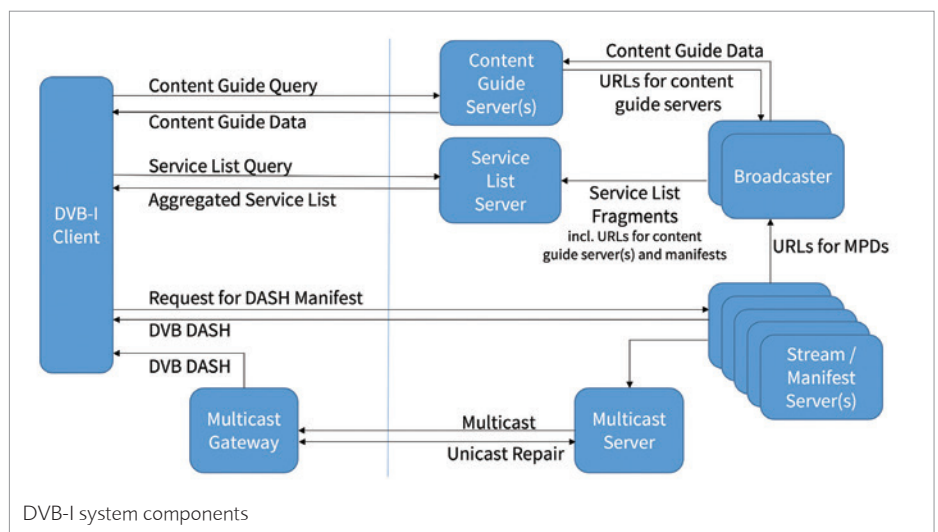
Paul Higgs is co-chair of the DVB Technical Module working group for IP Infrastructure, where he leads the technical specification work for DVB-I.

The promise of DVB-I – a broadcaster perspective

DVB-I comes at a fascinating time in the broadcasting industry – the unprecedented consumer demand for content brings as many challenges as it does opportunities. By now we are all acutely aware of factors such as content aggregation and service bundling, which increase the surface area of content discovery far beyond the realm of traditional broadcast media. Equally challenging are the regulatory and commercial forces that are making IP distribution a necessary consideration for broadcasters.

BROADCAST & IP

ITV and fellow shareholders in UK platforms like Freeview Play, YouView and Freesat are well familiar with using DVB standards to meet this challenge, weaving IP experiences into the broadcast world. Platforms like Freeview Play are established to build upon the strength of linear broadcast viewing and extend it into the IP world, sustaining the prominence of the broadcasters who offer such unique contributions to the fabric of their national culture.

If there is one thing Freeview Play has proven in the UK it is that a careful curation of open industry technology standards underpins and drives the success of products designed to maximize the value of broadcast content to manufacturers and consumers in an increasingly digital world.

DVB-I specifications are designed to tackle the challenges of delivering first class broadcast content using IP technologies and offer a common approach to derive this value across the broadcast industry. Whether it's delivering seamless high resolution playback using low latency DVB-DASH or Multicast ABR, sustaining broadcaster prominence on IP-delivered services, or rich programme metadata and imagery powering content discovery, DVB-I is shaping up to deliver a strong foundation for broadcasters wishing to focus on engaging with the challenges and developing the potential in these opportunities.

In distribution too, DVB-I provides the tools for making IP delivery a scalable reality, while sustaining discovery of cable, satellite and terrestrial distribution. With enough will, the promise and value of the horizontal market can continue despite the changing landscape.

STANDARDS FOR SUCCESS

Despite this, one could argue that it is facile to view DVB-I simply as a means to sustain the broadcast status quo in a differing distribution technology. The world is changing and while this does present real challenges, change always comes with the opportunity to ask how might we do things differently, better?

It's clear that by coming together on making and adopting open industry standards to solve the common challenges we face, we free ourselves to do what broadcasters have always excelled at, and that is creating amazing content experiences.

Crucially, it's the facility, within the realm of IP technology, to use data to build and sustain direct relationships with our viewers, and to offer personalized content experiences, more relevant advertising and ongoing improvement of service, which are in the DNA of all successful digital experiences.

With so much competition and demand for great content, the time is now to set the foundation of the future with DVB-I; but of course, it's what we can do with it that really counts.

> DVB-I IS SHAPING UP TO DELIVER A STRONG FOUNDATION FOR BROADCASTERS WISHING TO FOCUS ON ENGAGING WITH THE CHALLENGES AND DEVELOPING THE POTENTIAL IN THESE OPPORTUNITIES.

Matt Poole is Head of Architecture for Direct to Consumer services at ITV in the UK. He also co-chairs the DVB Technical Module's working group for IP Infrastructure where current work items include DVB-I, Low Latency DASH, Multicast ABR and Targeted Advertising.

A rich tapestry of hybrid platforms emerges across Europe

Freeview is the digital terrestrial platform in the UK, used in 19 million homes. HbbTV 2.0.1 has been a requirement in Freeview receivers

The red button (or its local equivalent) has become well established across Europe for launching channel-bound HbbTV apps that deliver additional content and services. A more recent evolution is the growing number of platforms driven by HbbTV, enriching the digital broadcast offer and ensuring the continued strength of horitzontal markets.

We're pleased to present this overview of some of the most significant platforms, based on information compiled by the HbbTV Marketing and Education Working Group.

Not covered here is the Salto platform, a proposal from the three major broadcasting groups in France (France Télévisions, M6 Group and TF1 Group) that, at the time of writing, is awaiting approval from the competition authority in France.
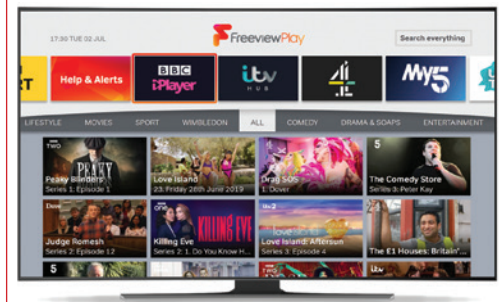
It seems likely that Salto, which is a response to the challenges posed by new OTT and SVOD players like Netflix, will have many similarities to the platforms described on these pages, though with more emphasis on premium/SVOD services. Although not yet announced, DVB Scene understands one of the ways for viewers to access Salto would be via an HbbTV application, possibly based on the latest OpApp specification. This would be in line with the inclusion of HbbTV 2.0.2 in the device requirements recommendation published by France's FAVN (Forum Audiovisuel Numérique) in February 2019, and also with the DTT roadmap issued by CSA (Conseil supérieur de l'audiovisuel) in February 2018.

LOVESTV (SPAIN)

Launched in June 2018, LOVEStv is an open, universal and free-to-air hybrid service mixing the best of DTT distribution and broadband connectivity. It enhances DTT by offering a single and premium user experience to viewers, with features like start-over of the current programme, seven-day catch-up and editorial recommendations.

LOVEStv was launched by the main free-to-air commercial and public broadcasters in Spain – Mediaset, Atresmedia and Radio Television Española – and is open to all DTT broadcasters in the country.

Thanks to the HbbTV standard, LOVEStv provides the same user experience across TV manufacturers in the Spanish horizontal market. Almost 4 million TV sets in the Spanish market are capable of receiving the LOVEStv service. The number of users is growing thanks to the renewal of the installed TV base and the growth of broadband connectivity.

Naturally there is still room for improvement, through the addition of new features, more broadcasters and more devices. It is also planned to add new ways to access the content as well as new ways to monetize the content through targeted advertising.

FREENET TV CONNECT (GERMANY)

freenet TV offers top commercial channels in HD quality at a competitive price via both terrestrial and satellite networks. It was set up and is marketed by Cologne-based Media Broadcast, which also developed Germany's state-of-the-art DVB-T2 network. freenet TV connect complements the freenet TV offering on DVB-T2 with additional channels, applications and catch-up services. It uses HbbTV as the basis for hybrid media services on reception devices with an internet connection. The IP streams of the additional content, sent using DVB-DASH, appear directly in the channel list. Users can seamlessly switch between the conventional broadcast channels and IP channels without any media disruption.

The freenet TV connect portal offers access to additional TV and radio channels, catch-up services of the different channels, apps, on-demand offers and an intelligent programme guide. The channel portfolio comprises different types of channels, including services that are neither linear streams nor catch-up services. Motorvision and Spiegel.TV are playlist apps that integrate pre- and mid-rolls of the marketing partner using the VAST standard (Video Ad Serving Template). ran FIGHTING is a pay-TV channel that freenet TV customers can subscribe to as an add-on option.

since 2016 and is the basis for the migration of Freeview to a fully hybrid digital terrestrial and IP platform. With seven million HbbTV devices sold and over four million actively using video on demand, Freeview now represents a connected TV platform bigger that than the UK's cable and IPTV pay-TV operators.

The Freeview Play model is to support the horizontal TV and set-top box markets, leveraging HbbTV to minimize customization costs for manufacturers and content businesses. For broadcasters it has created a standardized path to gaining a presence on smart TVs, while manufacturers are benefiting from the adoption of HbbTV across Europe. As a result, the UK has one of the most compelling hybrid free-to-view propositions in the world, with highly popular live, interactive and on-demand content from all the big broadcasters available on smart TVs.

Freeview Play provides UK viewers with access to live, interactive and on-demand content from all the big broadcasters.

LOKAL-TV-PORTAL* (GERMANY)

The Lokal-TV-Portal aims to improve the findability and the permanent availability of local television programmes. Live streams and media libraries ensure that local stations without their own – or with time-limited – satellite or terrestrial distribution can be accessed by the majority of households in Germany. This cost-effective solution is one effective means of increasing the economic viability of local stations.

Instead of a programme guide, the Lokal-TV-Portal makes available a kind of "channel guide" of more than 80 programmes from eight federal states in Germany. Distribution is done via satellite and DVB-T2 HD in addition to the typical local distribution via cable. To select a channel the user moves horizontally through the participating federal states and afterwards vertically to choose a channel in a given state. Most of the channels have a live signal even in preview mode. While the red button selects the channel, the yellow button provides additional information. There is also space for three local images alongside the live preview.

The memory function in the HbbTV application allows returning users to return to the last selected channel, which means a favourite local channel can easily be found within the huge number of satellite channels, again without having its own satellite slot.

Local content is limited: typically about one hour per weekday is produced. This means that VOD is a good alternative to 24/7 live distribution. Each local channel can measure their audience easily on their own. The usage of local television content is now growing due to the rising number of HbbTV connected households.
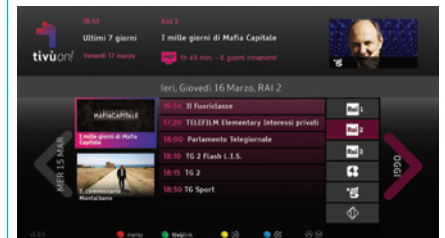
Information provided by the BLM (Bavarian regulatory authority)

How is low latency achieved in DVB-DASH?

Basic information flow for a low latency DASH service (Image courtesy of Thomas Stockhammer)
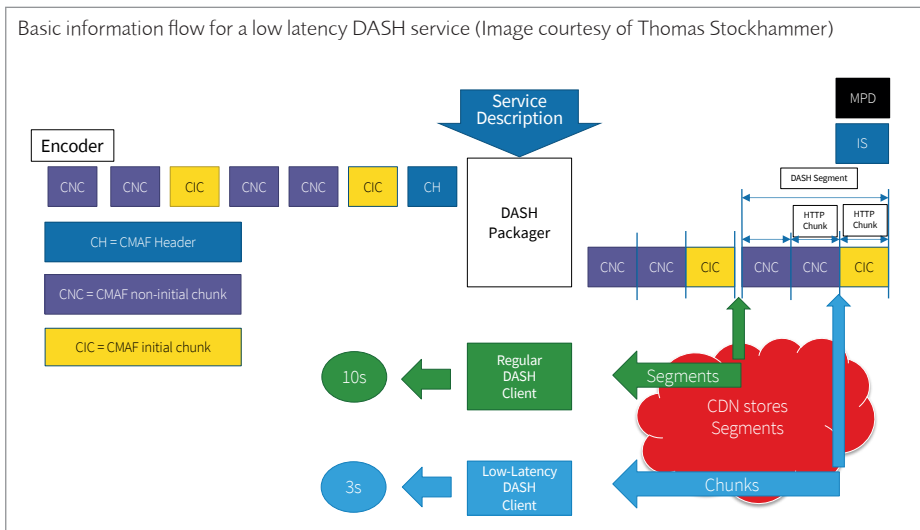
Writing in these pages one year ago, my colleague Chris Poole (BBC Research & Development) explained the need to add a low latency mode to DVB-DASH. While Chris focused on *why* low latency is important (to enable streaming of live content with a delay comparable to that of broadcasting; to facilitate personalization of live broadcast content with insertion of internet-delivered content), now that the updated DVB-DASH specification has been approved, I'm going to focus here on *how* low latency is achieved.

It's important to note that the latency – or delay – in broadcast services is not a universal value and is influenced by many factors. Most measurements converge on a 3–10 second latency from when the signal is acquired for encoding to when it's displayed on a TV.

Much of the latency in internet-delivered content is introduced in the DASH player, due to the segment length and unknown performance of the delivery network. The player policy is to typically buffer multiple segments to reduce the possibility of stuttering. It has already been possible to achieve lower latency by having shorter segments, e.g. of <1s rather than the typical ~5s. However, shorter segments make it harder for the encoder to do an efficient job, which means the quality of the video seen by the end user suffers (for a given bandwidth).

SEGMENTS INTO CHUNKS

The solution, therefore, for low latency in DVB-DASH is to break segments into smaller chunks. Instead of outputting units of a segment at a time, the encoder splits the segments into groups of frames, where none of the frames in a group requires a frame from a later group to enable decoding. The encoder is configured to output a group of frames around every 960 ms. The DASH packager then puts each group of frames into a CMAF chunk and pushes it to the CDN (content delivery network). (CMAF, the Common Media Application Format, was developed by MPEG to standardize the encapsulation of encoded audio and video frames.)

When a DASH client wants to stream a service, it uses the Media Presentation Description (MPD) file to learn about the parameters of the service. Normally, the MPD signals the availability of a segment as being after the complete segment is available. Now, with low latency mode, the MPD signals the time when the segment will start to be available as the first chunk is pushed to the CDN.

The player requests the segment from the CDN at its earlier availability time and the CDN delivers the first chunk. Subsequent chunks are delivered to the player as and when they are pushed to the CDN. Instead of buffering complete segments, the player buffers one or two chunks. To further reduce the latency, it starts to play a segment before it has received the final chunk. (Remember that the chunks contain groups of frames that can be decoded without needing any frame from a later chunk.)

All of these steps cut down the end-to-end latency from 20–30s to 3–4s. Mission accomplished!

DASH-IF & MPEG

Hooks added to the DASH MPD by MPEG specify how the low latency service should be consumed. These include a target latency that the player should aim for, along with minimum and maximum latencies. If the player regularly exceeds the latter, it should drop out of low latency mode and consume the content in regular DASH mode.

DVB has collaborated closely with the DASH Industry Forum to deliver this work. DVB and DASH-IF will jointly fund interoperability and testing activities for the specification. The new version of DVB-DASH also adds support for signalling of Dynamic Mapping for HDR video and DTS-UHD audio.

> MUCH OF THE LATENCY IN INTERNET-DELIVERED CONTENT IS INTRODUCED IN THE DASH PLAYER, DUE TO THE SEGMENT LENGTH AND UNKNOWN PERFORMANCE OF THE DELIVERY NETWORK.

Simon Waller led the DVB TM-IPI task force that developed the low latency specification for DVB-DASH. He has recently retired from Samsung Electronics R&D Institute in the UK, where he worked on business development and industrial affairs.

DVB-S2X evolves to support beam hopping

Multi-beam satellite platforms based on DVB-S2X technologies are used worldwide to provide broadband services and internet of things, including in areas where terrestrial broadband infrastructures do not meet user requirements, or where ubiquitous coverage is required for airborne or maritime mobile users. There are also several initatives to deliver ubiquituous broadband coverage by non-GEO (geostationary equatorial orbit) multi-beam satellites.

Beam hopping (BH) is a known technique in multi-beam satellite systems that enables efficient and flexible use of satellite resources. In July 2019, the DVB Steering Broad approved a revised version of DVB-S2X (EN 302 307-2), adding support for BH systems. The commercial requirements for these amendments had been finalized by the Commercial Module in October 2018. Applications highlighted included VoIP, cellular backhaul, Internet of Things, maritime and in-flight connectivity and government.

BEAM HOPPING BENEFITS

Several studies have shown that the use of BH can reduce the total payload power requirement, increase useable capacity and reduce unmet capacity requests, particularly in the presence of traffic demand variations over time in different coverage cells. While the super-framing structure of DVB-S2X had been used to demonstrate BH functionality over the air, the need for more elaborate solutions to support a variety of scenarios was recognized by DVB Members.

In November 2018, the DVB Technical Module's TM-S working group started work on identifying the technical gaps in the current DVB-S2X specifications and preparing a generic BH model.

As shown in Figure 1, the BH cells covering the territory are grouped in "clusters of cells"; the cells of each cluster (e.g. the yellow cluster) are visited by the satellite beam (which can be composed of a single carrier signal, or of multiple carrier signals, even with different symbol rates) in successive illumination periods. The illumination periods may be cyclic and pre-planned or random (i.e. immediately following the traffic demand). Thus, while the "normal" S2X receiver operation mode is continuous, a beam hopping receiver has to operate with "bursty" signals, and this requires the need for a long preamble preceding the useful data payload, to enable receiver (frequency, phase, timing) synchronization. A post-amble is required as well, to allow the satellite beam to switch from one cell to the next.

NEED FOR FLEXIBILITY

The main technical requirement arising from the gap analysis was for greater flexibility: (i) of the cell illumination period (cyclic or traffic driven, lasting from hundreds of ms down to tenths of ms); (ii) of the available SNR (from 25 dB down to -10dB); (iii) of the complexity of in-band signalling (cell addressing, pointers to allow physical-layer frame fragmentations, PL-Frame Header Protection level, pilot structures, etc.).

Two solutions were proposed by working group participants. In order to evaluate them, beam hopping channel models were developed under the leadership of ESA, the European Space Agency, and receiver acquisition and tracking performance were evaluated via extensive physical layer simulations.

The optional super-framing structures that enable support of advanced techniques for broadband interactive networks are described in Annex E of DVB-S2X. Following the comparison of the proposed solutions, TM-S agreed to develop three new formats in Annex E. The new formats (numbered 5, 6 and 7) are characterized by a flexible super-frame length to cope with short cell illumination times; and they allow multiple super-frames per illumination, to reduce the signalling overhead when the available SNR is not extremely low.

TM-S will now undertake further work on verification and validation, and will support development of upper layer signalling for BH within the TM-GBS group. The DVB-RCS2 specification will also be updated, as will the DVB-S2X Implementation Guidelines.
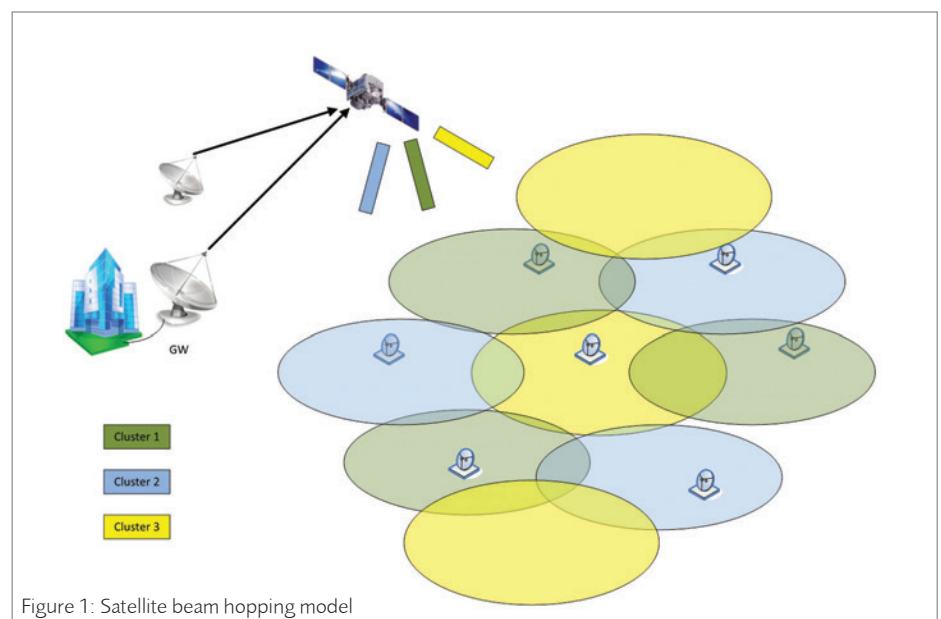

Figure 1: Satellite beam hopping model

Alberto Morello is head of the RAI Centre for Research, Technological Innovation and Experimentation (CRITS). He is the chair of DVB's Technical Module working group on satellite
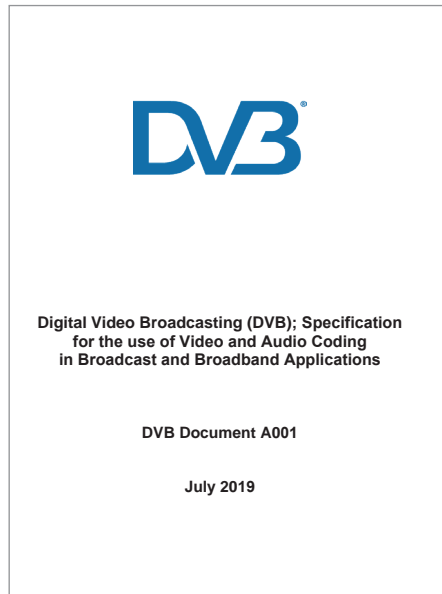
HDR Dynamic Mapping added to DVB's UHD toolbox

The DVB specification for UHD services and receivers, embedded within the *DVB Specification for the use of Video and Audio Coding in Broadcast and Broadband Applications* (ETSI TS 101 154), contains two technologies for the coding of High Dynamic Range (HDR) video, namely Hybrid Log Gamma (HLG) and Perceptual Quantization (PQ). Both are specified in ITU-R Recommendation BT.2100-1. "PQ10" refers to the PQ variant using 10-bit sampling.

PQ & METADATA MAPPING

HLG extends the dynamic range while maintaining compatibility with the legacy system. In contrast, the PQ system defines new algorithms that enable absolute luminance values in the range 0 to 10,000 cd/m^2, whereby the HDR signal is referenced to the display that was used when the HDR video content was graded, typically a high-performance professional monitor. As a consequence, when PQ video content is viewed on a display that has different characteristics to the reference display used in production, in particular on a display having a significantly lower peak luminance capability, the video signal has to be mapped to the characteristics of that display. This mapping is performed by the TV as part of the video decoding and rendering process, which generally also includes adaptation to the current viewing conditions and applying user preferences.

The original DVB UHD specification including HDR specified only static metadata for PQ10, signalling HDR-relevant properties for the complete content asset. Obviously, most content contains scenes of varying overall brightness, and intermittently contains pictures with extremely high or low-luminance areas, which benefit greatly from HDR, hence the desire to enable Dynamic Mapping (DM).

Once it was agreed that the time was

Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcast and Broadband Applications

DVB Document A001

July 2019

> MOST CONTENT CONTAINS SCENES OF VARYING OVERALL BRIGHTNESS, AND INTERMITTENTLY CONTAINS PICTURES WITH EXTREMELY HIGH OR LOW-LUMINANCE AREAS, WHICH BENEFIT GREATLY FROM HDR, HENCE THE DESIRE TO ENABLE DYNAMIC MAPPING.

right to start work on the consideration of HDR DM technologies for inclusion in the DVB codecs specification, CM-AVC set to work and the Commercial Requirements for HDR DM were drafted, and approved in July 2018.

The subsequent call for candidate technologies resulted in three proposals:

- SMPTE ST 2094-10 – Dynamic Metadata for Color Volume Transform — Application #1;

- ETSI TS 103 433-2 (SL-HDR2) – High-Performance Single-Layer High Dynamic Range (HDR) System for use in Consumer Electronics devices; Part 2: Enhancements for Perceptual Quantization (PQ) transfer function based High Dynamic Range (HDR) Systems; and
- SMPTE ST 2094-40 – Dynamic Metadata for Color Volume Transform — Application #4.

The candidate solutions were ratified via the usual process for new codecs, and it was agreed to adopt all three candidate solutions.

The support of HDR DM is optional, both in video content and in TVs and receivers. If HDR DM is present, all HDR TVs will be able to display an HDR (PQ10) image, but those that understand the new information will be able to better map the content to the capabilities of the TV. This is particularly beneficial for TVs that are not able to display the full dynamic range of the source content, and do not have an internal dynamic mapping system.

BROADCAST & BROADBAND

As well as specifying the actual usage of each HDR DM system, ancillary signalling for both MPEG-2 Transport Stream and DVB-DASH container formats needed to be specified. This was done in collaboration with the TM-GBS and TM-IPI groups, so that the complete set of specification revisions could be approved by the DVB Steering Board in July 2019. The latest version of the DVB video and audio coding specification is available as DVB BlueBook A001. ETSI publication is expected in due course.

The remaining task concerning HDR DM concerns V&V – verification and validation. Work is currently ongoing to produce reference bitstreams containing PQ10 video content and HDR DM, for use by the industry to test relevant implementations.

Paul Szucs is Senior Manager, Technology Standards at Sony Europe. He is vice-chair of the DVB Technical Module subgroup on audiovisual coding, TM-AVC.

The basic NHK STRL results

- At 0.75H the screen becomes more invasive and quality apparently falls.
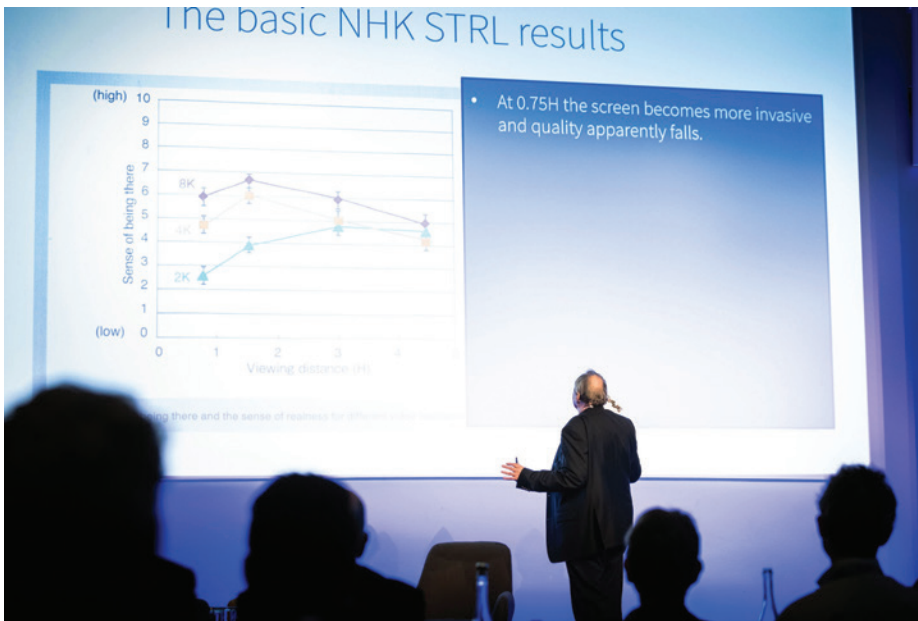
David Wood spoke about 8K at DVB World 2019

Is 8K a serious prospect on broadcast and broadband?

In 2018, DVB launched a study mission to understand the landscape for 8K and other new systems that may come after the DVB 4K system. Initial enquiries showed that the "over-the-horizon" systems most on the minds of DVB Members are 8K and 360VR.

8K is the upper level in the ITU specification for UHDTV (BT.2020-2), with the same technical parameter values as 4K, except with more static resolution. Image quality influences how long the viewer will sustain his viewing of given programmes.

The higher the perceived image quality, the longer the time the content will be watched.

8K SETS ON THE WAY
In 2018, TV set manufacturers announced plans to make 8K TV sets and satellite operators undertook successful transmission tests with 8K. Japan and Korea have long made plans for 8K services. But there was also considerable caution in DVB. If the message went out that 4K was superseded, there would be annoyance for 4K TV set purchasers and, in many cases, businesses would be hurt.

Set makers believe that it will be no more difficult to mass-produce 8K TV sets than 4K TV sets, so prices will drop to the point where they are affordable by the public. And there will be a case for buying an 8K TV for the up-scaling benefits, even without 8K content.

NHK studies with an 85" screen suggested that, if the viewer gets closer than 1.5H (1.5 times the height of the screen), the "sense of reality" falls off – the presence of the screen becomes annoying. The tests also showed that if the viewer is further from the screen than 4H, then HDTV, 4K, and 8K images all look nearly the same. So, there is a sweet spot for 8K of 1.5H to 2H.

Production infrastructures would obviously need to be upgraded to cope with 8K. Coupled with that, 8K production can be a different game in terms of production grammar, makeup, scenery and much else. Although 8K production could be done in "production islands", it may have to wait for the next studio re-equipment cycle, which can take up to ten years. Furthermore, there is very little 8K production equipment available yet and the first-generation equipment that *can* be found is expensive.

DELIVERING 8K
8K delivery today using current compression algorithms needs between 60 and 90 Mbit/s. There are projections that new compression algorithms will be available in the next five years that will need about half that bit rate. But even with today's compression algorithms, 8K is within the capacity of DTH (direct-to-home) satellites. The bit rate using today's compression is arguably beyond the capacity of terrestrial broadcasting.

Available internet bit rates vary considerably across and within nations, but if we do arrive at compressed 8K bit rates of 30-40 Mbit/s, a proportion of broadband homes could be provided with 8K programmes in the next ten years. If 5G realizes the very high bit rates promised it may be a candidate.

In summary, a principal factor encouraging 8K is likely to be the availability of 8K TV sets at affordable prices in the coming years. A principal factor acting as a barrier to its success is that 8K is today significantly disruptive in terms of production and delivery.

For a new disruptive media technology to succeed, it is said that there must be significant gains by all parts of the chain, from programme-maker to viewer. The question is whether this can be met for the totality of 8K production, delivery, and display.

David Wood is a consultant to the EBU Technology & Innovation Department. He led the DVB CM-AVC *Study Mission on Media Forms beyond UHD-1 (4K)*.

DTT in Kenya: more content, more jobs and a digital dividend

Planning for the analogue-to-digital television migration in Kenya began in 2006, immediately after the GE-06 Agreement. The government had a vision that the migration would not only deliver improved and diversified audiovisual content to Kenyan consumers, but would also utilize spectrum more efficiently and effectively, thus freeing up a "digital dividend" for mobile services.

A phased switchover was implemented, starting with Nairobi and followed by the most urbanized areas, where uptake of digital services was expected to be high. This approach ensured that lessons learnt in a previous switchover area could be applied in subsequent areas.

The exact date for the switchover of each analogue transmitter was published and publicized six months in advance, based on the roll-out plans of the public signal distributor, as approved by the regulator. Dates for analogue switch-off and digital switch-on in the same areas or neighbouring target areas were carefully synchronized to avoid interference and service interruption.

FIVE DISTRIBUTORS

DTT (digital terrestrial television) infrastructure, based on DVB-T2 with MPEG-4 video coding, was initially rolled out by two Broadcast Signal Distributors (BSDs): SIGNET and Pan Africa Networks Group (PANG). However, following the Supreme Court of Kenya ruling in September 2014, the Communications Authority of Kenya (CA) introduced a new licence category of self-provisioning BSDs to complement the provision of DTT infrastructure. By July 2017, three entities – Africa Digital Network Ltd (ADNL), GOtv Kenya Ltd (GOtv) and Lancia Digital Broadcast Ltd (BAMBA TV) – were issued with self-provisioning licences.

The digital switchover in Kenya not only saw the number of locally produced channels increase from a mere five to over 100, but also introduced pay-TV on terrestrial platforms at an affordable price. As a result, the country now has two pay-TV platforms offering local and international productions, including sports, drama and blockbusters. This has resulted in increased local content production and the creation of much-needed jobs. In addition, some well-known international public broadcasters have seized the opportunity to have DTT channels in Kenya.

In 2017, the CA reviewed the BSD pricing and access framework and issued a new determination that divided the country into three areas with regard to signal distribution charges: Nairobi, other cities and urban areas, and rural areas. This new framework saw the issuance of a standard Reference Access Offer (RAO) and a further reduction in signal distribution tariffs from the prices it had prescribed in 2013.

FURTHER GROWTH

Following the successful completion of analogue switch-off in June 2015, the CA continued to assign digital television frequencies to the five signal distributors. The table below shows the total number of programmes carried in the multiplexes assigned to the signal distributors as of 30 June 2019.

The public BSD, SIGNET, operated by the national broadcaster Kenya Broadcasting Corporation (KBC), is in the process of acquiring a new headend and local insertion systems (to be installed at six sites across the country) in order to expand its DTT capacity.

By 30 June 2019, the total population coverage of the DTT network was estimated at 86%. The population coverage is derived by the CA by considering the combined coverage of both the common carriers and the self-provisioning BSDs mapped against the official population census data.

	SIGNAL DISTRIBUTOR	STATUS	NO. OF LOCAL PROGRAMMES
1	Africa Digital Network Ltd (ADN)	Self-Provisioning FTA	4
2	GOtv Kenya Ltd (GOtv)	Self-Provisioning Pay-TV	58
3	Lancia Digital Broadcasting Ltd (Bamba)	Freeview	19
4	Pan Africa Network Group (PANG)	Common Carrier FTA and Pay-TV	38
5	Signet Signal Distributors (SIGNET)	Common Carrier FTA	43

Daniel Obam works at the National Communications Secretariat, the statutory ICT policy advisory body to the Government of Kenya, as Communications Secretary/CEO. He was the Project Manager for implementing the roadmap for migration to digital television in Kenya.

SAT>IP: Broadcasting to IP devices in the home

SAT>IP network
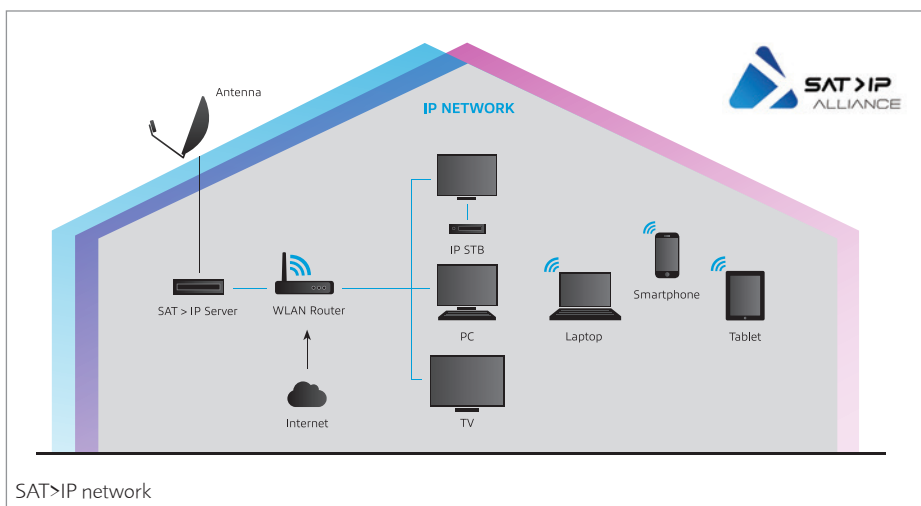
Despite all the hype about OTT video delivery, satellite broadcasting remains the most efficient means to deliver live linear content to millions of users in the highest picture quality. The desire of consumers to watch broadcast content also on portable IP devices such as tablets, notebooks and even mobile phones in a home environment had led to the development of the SAT>IP specification already back in 2011. SAT>IP was published in 2014 as the European standard CENELEC EN50585. It details how to convert DVB-S/S2/S2X, DVB-C/C2 and/or DVB-T/T2 signals into Internet Protocol (IP), using a small server device connected to the home IP router.

Supported by over 40 hardware and software companies, SAT>IP counts today about 100 compliant products. In 2015, the SAT>IP Alliance was formed to support the development and worldwide adoption of SAT>IP technology and to accelerate its adoption by the industry and in consumer markets. It promotes the use of the SAT>IP communications protocol, supports integration of CAS-to-DRM technology for distributing pay-TV services over in-home IP networks, and facilitates product certifications.

SAT>IP AND DVB

A major milestone has been the formal liaison agreement between the DVB Project and the SAT>IP Alliance, announced at IBC2017. The scope of this liaison is not only to jointly promote SAT>IP technology but also to provide the opportunity to the DVB community to contribute to next generation SAT>IP features and services. This work is now ongoing in the DVB Commercial Module's Home Broadcast working group – led by Nghia Pham of Eutelsat – where commercial requirements for a next generation in-home distribution standard for broadcast signals are being worked on.

A plethora of SAT>IP servers and hardware and software clients have been brought to the market. One exciting innovative example was the prototype of a SAT>IP LNB and a flat antenna with a 32-channel server. By far the most successful commercial implementation of the SAT>IP standard is its integration into many flat-screen TVs from Panasonic (a DVB Member), giving consumers the option to receive terrestrial, satellite and cable signals via in-home IP distribution and on a second TV set respectively. Entirely based on the EN50585 standard, Panasonic markets their implementation as TV>IP in the DACH markets and beyond.

THE FUTURE

Until today SAT>IP is the only standardized technology to convert DVB transport stream-based broadcast to an in-home distribution format suitable for modern IP devices. While it has gained significant traction with its integration into flat-screen TVs, it nevertheless has some limitations, such as:

- Eventual need of a CA to DRM transcription in the server;
- Optional transcoding of the original video format may be necessary;
- Final QoS linked to the quality of the home WiFi installation;
- Requirement to install a specific application on the IP device.

Some of these points will be addressed by the work of the DVB CM-HB group and may eventually lead to a new home gateway specification with two profiles: Profile A that shall comply with the delivery mechanism specified in EN50585:2014 (SAT>IP) and Profile B that shall be derived from the delivery mechanism specified in DVB-DASH (TS 103 285 V1.2.1).

Profile B may gain significant market relevance with the standardization of a new native end-to-end IP broadcast format carried over the existing DVB transmission standards – a discussion that has just started in the DVB Project. By continuing to maintain existing SAT>IP compatibility while enabling DASH delivery compatible with DVB-I, DVB will offer to the SAT>IP ecosystem a completely new dimension of potentially addressable devices and will pave the way to a future delivery standard.

Thomas Wrede is VP New Technology & Standards at SES Video. He is president of the SAT>IP Alliance and chairs the DVB Commercial Module working group on Satellite.

Here's what you missed in Dublin.

Join us in Valencia!

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