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"DVB NEEDS TO STAND ON THE SHOULDERS OF ITS PAST SUCCESSES TO PREPARE FOR AN EXCITING FUTURE: NO SMALL CHALLENGE IN TODAY'S EVER CHANGING ENVIRONMENT"

Peter MacAvock

NEW DVB CHAIRMAN

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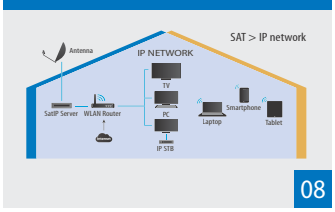

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Changing of the Guard
A Word From DVB

Peter Siebert
Executive Director

At the recent Steering Board meeting the DVB community bid farewell to Phil. This time around Phil Laven did not stand for the SB chairmanship. In his eight years as chairman major developments took place in DVB. DVB-T2, one of DVB's most successful transmission standards, became a worldwide success under his stewardship. We saw the ups and downs of 3DTV as well as the integration of the new HEVC video coding scheme into DVB specifications. HEVC has become the driver for UHD resolution and the ongoing activities for High Dynamic Range (HDR) and Next Generation Audio (NGA).

Over these eight years I greatly appreciated working with Phil. He had the natural ability of bringing together different opinions and achieving consensus. His experience and guidance during his term proved invaluable.

Peter MacAvock has been elected as the new DVB Chairman. Peter will be well known to DVB Members as he was the Executive Director of the DVB Project Office for 14 years and as such, my predecessor. In that time Peter was instrumental in setting up the Project Office and was deeply involved in all DVB promotional activities. The worldwide adoption of DVB standards is to a large part due to Peter and his efforts.

His first task as DVB Chairman will be the timely publication of the specifications for HDR and NGA as the broadcast industry is eagerly awaiting these new features. For the last 26 years, the performance of HD TVs was defined by ITU-R BT.709, which was still based on the capabilities of cathode ray tube displays. Now BT.2020 allows for TVs with wider contrast range, more color and higher frame rates. The underlying technology for these new features in a broadcast environment is currently being discussed in intense debates in TM-AVC.

I am optimistic that once the specification is published we will see an immediate deployment of compliant equipment and new services. HDR and NGA combined with HD or UHD resolution will bring a new quality experience to the end-user. It also clearly shows that broadcast is still an innovative industry. I am looking forward to working together with our new Chairman to take DVB to the next level.

New Standards

TS 102 773 Ver. 1.4.1:	Modulator Interface (T2-MI) for a second generation digital terrestrial television broadcasting system (DVB-T2) (Mar - 2016)
EN 300 468 Ver. 1.15.1:	Specification for Service Information (SI) in DVB systemsg (Mar - 2016)
TS 102 034 Ver. 2.1.1:	Transport of MPEG-2 TS Based DVB Services over IP Based Networks (Apr - 2016)
TS 102 542-1 Ver. 2.1.1:	Guidelines for the implementation of DVB-IPTV Phase 1specifications; Part 1: Core IPTV Functions (Apr - 2016)
TS 102 542-2 Ver. 2.1.1:	Guidelines for the implementation of DVB-IPTV Phase 1specifications; Part 2: Broadband Content Guide (BCG) and Content on Demand (Apr - 2016)
TS 102 542-3-1 Ver. 2.1.1:	Guidelines for the implementation of DVB-IPTV Phase 1specifications; Part 3: Error Recovery; Sub-part 1: Overview of DVB-IPTV Error Recovery (DVB-C2) (Apr - 2016)
TS 102 542-3-2 Ver. 2.1.1:	Guidelines for the implementation of DVB-IPTV Phase 1specifications; Part 3: Error Recovery; Sub-part 2: Application Layer - Forward Error Correction (AL-FEC) (Apr - 2016)
TS 102 542-3-3 Ver. 2.1.1:	Guidelines for the implementation of DVB-IPTV Phase 1specifications; Part 3: Error Recovery; Sub-part 3: Retransmission (RET) (Apr - 2016)
TS 102 542-4 Ver. 2.1.1:	Guidelines for the implementation of DVB-IPTV Phase 1specifications; Part 4: Remote Management and Firmware Update (Apr - 2016)
TS 102 542-5 Ver. 2.1.1:	Guidelines for the implementation of DVB-IPTV Phase 1specifications; Part 5: Content Download Service (CDS) (Apr - 2016)
TS 102 824 Ver. 2.1.1:	Remote Management and Firmware Update System for DVB IPTV Services (Phase 2) (Apr - 2016)
TS 102 826 Ver. 2.1.1:	DVB-IPTV Profiles for TS 102 034 (Apr - 2016)
TS 102 905 Ver. 2.1.1:	Technical Specification for DVB Services in the Home Network Phase 1 (Apr - 2016)

New Members

Rabbit Labs specializes in security for digital television utilizing DVB-CI and DVB-CI-Plus standards. **www.rabbitlabs.com**

TRANSRADIO SenderSysteme Berlin AG develops, designs and commissions modern digital broadcasting transmitter systems for broadcast and data communication. **www.transradio.de**

University of Luxembourg - Interdisciplinary Centre for Security, Reliability and Trust (SnT) conducts internationally competitive research in information and communication technology, ICT, with high relevance creating socioeconomic impact. **www.uni.lu**

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Italian Style

Implementing DVB-T2 with HEVC

Alberto Morello, Vice-Chair, TM

Transferring part of UHF television frequencies (the so-called 700 MHz band) to mobile broadband services, on a date between 2020 and 2022 is currently under discussion in Europe. In Italy, broadcasters are carefully planning for this 30% reduction of spectrum resources through the adoption of technical standards offering greater efficiency (MPEG-4/AVC, HEVC, DVB-T2), with the aim of maintaining the current number of television services and, at the same time, improving the video quality towards high definition (HD). In this scenario, the introduction of High Dynamic Range (HDR) combined with HD 1080p is considered to be important, since it offers a further step in the user experience without requiring the huge bandwidth expansion of 4K UHD.

> ...migrating TV services to HD using second generation technologies, which are 50% more efficient than the present MPEG-2.

To allay any concerns regarding possible interruptions to TV services during the transition, it is necessary to understand the evolution of TV display technology in the Italian market in the decade ahead (see the Rai projections in the graph), which is basically divided into three families:

- the first generation of standard definition TVs (identified by MPEG-2 / DVB-T), on which the migration from analog to digital TV was based, is now present in about one third of TVs in Italy;
- the second generation (identified by MPEG-4 / DVB-T) currently present in more than half of installed TVs and in 100% of HD TVs;
- the third generation (called HEVC / DVB-T2), which is already present in 10% of the latest TVs and will be mandatory by law in Italy in new TVs and decoders from 1 January 2017. To avoid receiver compatibility issues for HDR content, the Italian HD-Forum technical specification selected the HEVC main-10 profile.

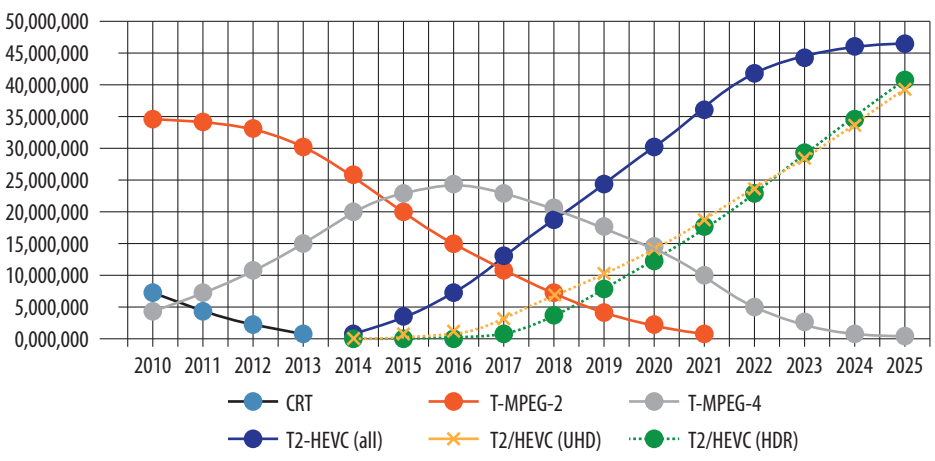
Each generation of TV receiver is also backwards compatible with the previous one, and then it is up to the broadcasters to respect the natural life cycle, taking care of the backward compatibility of the transmitted signals.

In particular around 2020-2022, when the 700 MHz band will be lost, in Italian homes the first generation legacy will be virtually exhausted (orange curve), while there will be 30% of second generation TVs (grey curve) and 70% of third generation (blue curve). Rai (along with the other main terrestrial broadcasters) will choose to migrate its TV services to HD over the second generation technologies, which are 50% more efficient than the present MPEG-2. Rai is also planning to begin simulcasting some programs in HD-HDR using HEVC / DVB-T2, to provide even better quality to consumers who have bought TVs after 2017. This will enable the public to continue to use their existing televisions throughout their natural life without having to purchase decoders, as was the case during the analog switch-off, while those who have newer TVs will be able to enjoy HD/HDR images of unbelievable quality.

As shown by the graph, the second generation MPEG-4 / DVB-T technologies may be abandoned only around 2025, when legacy receivers will naturally come to their end, and the HEVC / DVB-T2 technology will be extended to all the terrestrial muxes, offering new opportunities for UHD/HDR content over terrestrial networks.

Alberto Morello graduated in Electronic Engineering from Turin Polytechnic in 1982 and took his doctorate degree in 1987. He joined the Research and Technology Innovation Center of RAI-Radiotelevisione Italiana in 1984 where he is now Director. Dr. Morello is the Vice Chairman of the DVB Technical Module and leads the satellite group which defined the DVB-S, DVB-S2 and S2X systems. He has been the Chairman of the EBU Technical Committee for two terms. He is the author of various technical and scientific articles.

Estimated number of TVs in Italian homes in relation to implemented technologies



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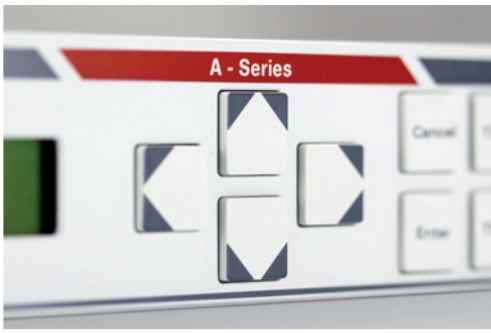

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Virtual Reality & the Hot Dog

A Study Mission Update

David Wood, Chair, DVB Study Mission Group - VR

Every fan at the ball game knows the important decision he or she has to make – which end of the 'Hot Dog' to bite? We face a parallel situation in Virtual Reality. There are two "ends" to the VR Hot Dog - but for this game it is essential to bite both ends at the same time in concert.

Unless there are agreed VR standards, the multiplicity of proprietary systems may mean that the VR ship never leaves the harbor, or at least remains as just an occasional pleasure boat. But there are, all at the same time, a huge number of issues to resolve before we can set down on paper the technical requirements or the best standards for VR that will last. This is a complex world.

DVB established a study mission to suggest what steps DVB should be taking in VR. How (in a manner of speaking) do things look in VR?

At one end of our VR Hot Dog are a multitude of options for combinations of technologies for making and delivering VR content. We need to establish which will be the practical and useful.

At the other end of the VR Hot Dog is the multitude of types of content that might conceivably be helped by VR. Which of these could be commercially successful?

The two ends of the Hot Dog have to fit together. There is a middle part too, which links the two ends – the psycho-physics of motion sickness. Together with all that we need matching audio – often said to be not just an addition to VR but a multiplier of the quality of experience.

Somehow we have to match the kind of content that will be successful with a means to experience it without sickness, and to generate and deliver it in a way that is practical and economically realizable. Not an overnight job.

There have been a large number of trials: live events, live capture and post, entirely post, interactive content, many stereoscopic trials, and the new concept of the "light field".

> ...begin our analysis of content prospects by supposing that the kind of content that will be successful is that which takes us somewhere we would like to be physically present.

We might begin our analysis of content prospects by supposing that the kind of content that will be successful is that which takes us somewhere we would like to be physically present. This might mean being present in a sports stadium or a rock concert. On the other hand it may be uncomfortable to feel actually present in a drama situation – we might prefer the detachment of watching a TV screen for this.

We can also ask whether the content experience should be 'editorially driven' or 'viewer driven'. Some work suggests that viewers only like viewing VR for a short time – up to 20 minutes duration. If so, this means short form, rather than long form; content is needed – what will lend itself to this?

In terms of the technology, we need the optimum systems for capture, production, distribution, and the consumer. The shooting might be 2D or 3D. The transport may be unicast download, a real time stream, or a broadcast. The interaction may be single or multiuser. The coding may be tiling or something else, and finally the rendering display may be locally tethered or distant and untethered.

With this super abundance of options how should we move forward? One approach may be to try to first establish by experiment the image parameter values for static and dynamic resolution definition needed to ensure a convincing immersion, coupled with audio immersion. We also need to know the allowable delay time between head movement and the corresponding image display movement. There are also facts to be established about the onset of motion sickness, and how it can be avoided. Once we have these we could turn to case studies, and eventually to technical specifications.

Personally I have a feeling that VR will become a companion for television and not a substitute, and together they will achieve exciting things if we get it right. But it's a very complex Hot Dog. I wonder if there is any Cotton Candy?

David Wood has chaired the DVB CM-UHDTV group that prepared the Commercial Requirements for the DVB UHD-1 Phase 2 systems. David is Consultant, Technology and Innovation, for the European Broadcasting Union, and has previously chaired the ITU-R groups that prepared the Recommendation for UHDTV, ITU-R BT 2020. David leads the DVB's Study Mission Group on Virtual Reality.

LiveIP

A Practical Exploration

Willem Vermost, European Broadcasting Union

Willem Vermost joined EBU Technology & Innovation as Network IP Media Technology Architect in 2016. Before joining EBU, Willem gained 16 years' experience at the Belgian public broadcaster VRT in different expert roles.

For years we have taken it for granted that the future of content production lies with 'IP', with all its benefits. The exciting news is that we are now passing from theory to practice. One of the major proof-of-concepts trials has been that of the Belgian national broadcaster VRT, LiveIP. This project is a practical exploration that was made possible by building and operating a live TV production studio with state-of-the-art IP-enabled equipment using available interoperable open standards. It is the result of great collaboration between VRT, the European Broadcasting Union (EBU) and a group of innovative broadcast technology partners including Axon, D&MS, Dwesam, EVS, Genelec, Grass Valley, Lawo, Nevion, Tektronix and Trilogy.

Why?

Today's digital environment has a clear impact on audiences. Consumers want to be able to consume more media at anytime, anywhere and on any device. This obliges media organizations to provide new formats, and to package their content for different media delivery platforms.

This ongoing business transformation would be difficult to achieve using the current SDI-based technology as it is not flexible enough to adapt to the continuous and rapid changes. Whilst IP is often said to be the technology to support that transformation, there are many questions in the industry about its readiness for live production; can it, in its present state, bring to professional live media, the transformation seen in other areas such as telecoms, or media post production?

How?

The best way of answering these questions is to actually try out this new technology in a real environment. The project was set up with many short phases, built around typical workflows: single camera, multi camera, remote production, live TV shows. During the summer holidays the setup will even be used for a daily production.

What technology is being used?

This project started in spring 2015 and the design of the system was based on the technology that was available at the time and that vendors had committed to provide working implementations of during the course of the project.

The topology used for the IP network is the so called Spine-Leaf architecture. It is a software defined network which deals with the routing of the media streams. To transport the uncompressed video: SMPTE ST 2022-6 was used[1]. As in many SDI-based television studios, audio is usually carried separately from the video. A combination of AES67 and the RAVENNA open standard is used[2].

Just like in a traditional SDI-based studio, an SDI-over-IP studio requires the end devices to be precisely synchronized. IEEE 1588-2008 or Precision Time Protocol (PTP) is the recognized way to achieve precise-enough time distribution over a network[3]. Not all video equipment at the time was capable of using PTP during the project. A brief overview of the setup is shown in Figure 1.

What to conclude?

From the LiveIP experience we can conclude that it is possible today to build a Live & IP studio. No real blocking barriers were encountered throughout the entire project. The setup has proven to be more flexible because it requires less cabling and is more about how you configure it.

Further development

To unlock all the possibilities IT-based systems can provide, some further development is needed. To name a few: elementary flows, discovery & registration, virtualization, …

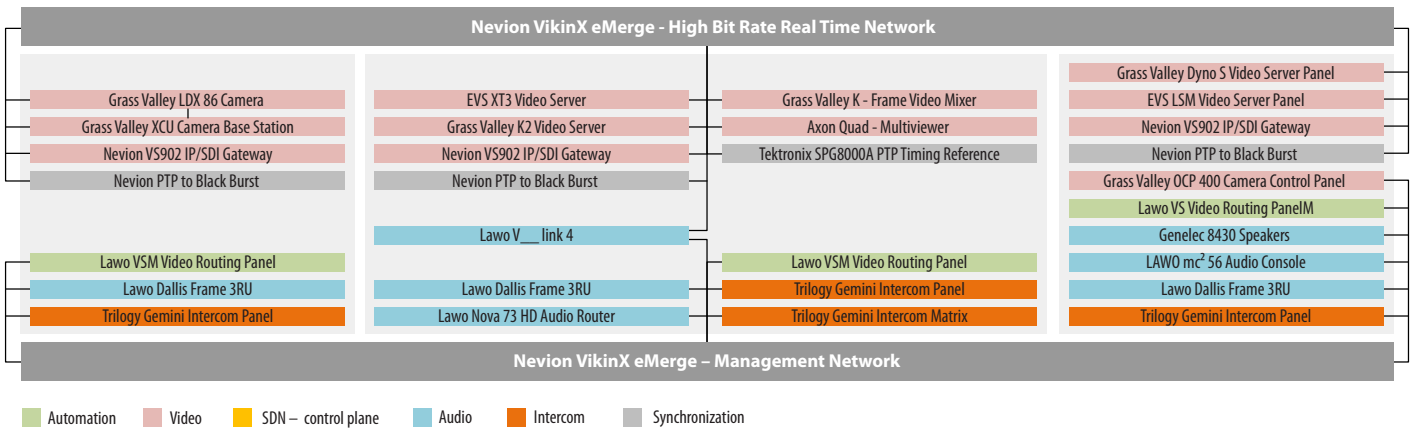
In order to help the broadcaster members of the European Broadcasting Union, a working group has drawn up what it believes will be the evolution of the technology over the coming years. The 'roadmap' was welcomed by many organizations, and has been adopted by the Joint Task Force on Networked Media (JT-NM).

[1] SMPTE ST 2022-6:2012 Transport of High Bit Rate Media Signals over IP Networks (HBRMT)

[2] AES67-2015 AES standard for audio applications of networks - High-performance streaming audio-over-IP interoperability / http://ravenna.alcnetworx.com

[3] IEEE 1588-2008 Standard for a Precision Clock Synchronization Protocol for Networked Measurement & Control Systems

Figure 1. System Diagram



Sat>IP

Live Broadcast over in-home IP Networks

Thomas Wrede, SES

Thomas Wrede is Vice President, Reception Systems at the satellite operator SES. He represents SES in the DVB Commercial Module as chair of the CM-S subgroup.

Roughly 10 years ago satellite operator SES initiated discussions both internally and with industry partners about a Network Connected Tuner (NCT) which would output broadcasted video, audio and data streams directly onto an IP (in-home) network. The ultimate product design goal quickly turned into the concept of an IP-LNB, a Low-Noise Ku band block converter which would output live broadcast in IP format. However, at that time the semiconductor industry was not yet in a position to provide cost efficient integrated high bandwidth A/D converters and product development efforts had to be put on hold.

In early 2010 R&D experts from Sky UK, Craftwork and SES joined forces to develop a protocol specification for taking live satellite broadcast onto IP networks and this initiative resulted in the creation of the SAT>IP communications protocol.

With SAT>IP, satellite-delivered DVB-S/S2 RF signals are demodulated and converted towards IP right at the point of reception in a SAT>IP server. Such a conversion may happen already in the satellite antenna itself (IP-LNB), close to the antenna (SAT>IP Multiswitch or converter) or in a master STB. Effectively SAT>IP servers remove the DVB-S/S2 layer and replace it with an IP transport layer. The same principle can also be applied to DVB-T/T2, DVB-C/C2 and DVB-S2X signals. The SAT>IP communications protocol was eventually extended to cover all DVB broadcast platforms including IPTV delivery.

SAT>IP represents a typical server and client model where the server strips off the DVB layer and puts the video, audio and data (SI, EMMs, ECMs, …) into IP format. It is based on existing IP standards such as UPnP for addressing and device discovery and RTSP/RTP for session control and streaming (see Figure 1).

SAT>IP is fully transparent to free-to-air and encrypted broadcast signals where traditionally the decryption takes place in the client device.

Given the fact that traditional broadcast CA solutions cannot be decrypted in software and thus have difficulties being used on modern IP devices such as tablets and smartphones, it becomes necessary for operators to implement a CA to DRM conversion after reception of their signals by SAT>IP servers (see Figure 2).

The first commercial implementation of such CA to DRM transcription is well on its way at the operator of the HD+ platform in Germany and will enable subscribers to watch encrypted programs on their portable devices in the home.

The consumer benefit of SAT>IP is that this technology allows the watching of live TV on all kinds of IP devices connected to a home network. It also facilitates the "Future of TV is apps" vision which means that popular consumer devices do not need to have tuners anymore as these will reside in a server unit connected to the in-home IP network.

With SAT>IP no coax cable is required to view satellite, cable or terrestrial broadcast television on a second screen. CE manufacturer Panasonic has already integrated this technology in many of its flat screen TVs where the high-end models also incorporate a SAT>IP server.

SAT>IP was standardized by CENELEC in 2014 and is now supported by over 45 manufacturers who have launched close to 80 different SAT>IP server and client products. Leading chip manufacturers have now launched full-band capture chips that can receive the entire satellite IF spectrum allowing a single-receiver design to offer multichannel service with channels anywhere in the spectrum as well as advanced features like fast channel change. Such chips provide up to 16 tuners on one SoC (System on Chip). A recent development of a waveguide based Ku-band flat panel antenna with an integrated 32 channel SAT>IP server demonstrates what is technically possible today. For the camping market this flat panel antenna is available as a fully steerable (auto-pointing) version with an 8-channel SAT>IP server and 802.11ac WiFi capability. The latest generation servers comprise up to 32 simultaneous front-ends and can serve the same number of client devices with individual program streams. Of course these SAT>IP servers can process SD, HD and also Ultra HD programs.

DVB Members Eutelsat, Hispasat, Nagra, MaxLinear, Panasonic and SES have recently formed the SAT>IP Alliance, a nonprofit organization open to other manufacturers, to coordinate and market the SAT>IP technology worldwide.

SAT>IP is an ideal complement to the DVB suite of broadcast standards (DVB-T2, -C2, -S2 and –S2X) and allows live broadcast (based on transport stream technology) to be put onto IP networks in a very cost efficient manner long before the broadcast industry has moved to native IP transmissions. The SAT>IP Alliance hence considers DVB to be the ideal body to manage future extensions of the SAT>IP standard.

Figure 1

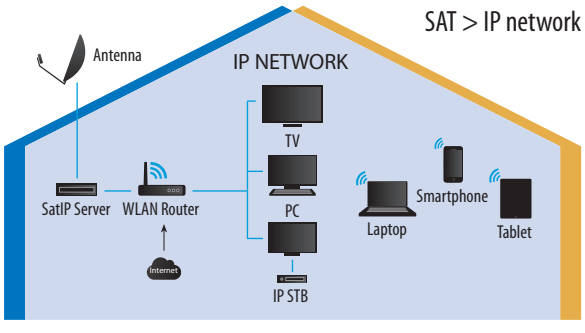
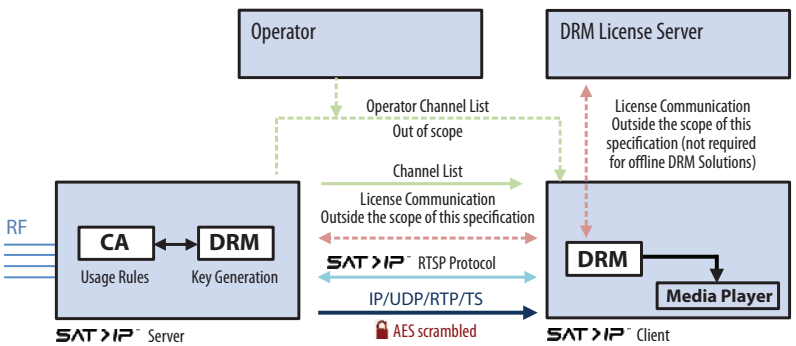


Figure 2



More DASH

Next Phase of DVB-UHDTV Over IP

Thierry Fautier, Harmonic

Following the definition of the DVB UHD-1 Phase 2 Commercial Requirements for broadcast, which were published in November 2015, DVB decided that the Commercial Requirements would also cover IP delivery using the DVB-DASH extended specification. This decision will lead to the upgrade of the DVB-DASH specification that today only supports resolutions up to UHD (UHD-1 Phase 1).

In addition to updating the DVB-DASH specification to support UHD-1 Phase 2, DVB is also working on a new initiative called "ABR Multicast." This initiative has been created to deliver adaptive streaming for live applications in a scalable way using multicast techniques over any IP network. For the time being the initiative is still at the requirements stage in the Commercial Module. Figure 1 provides a summary of all current and planned DVB Ultra HD (UHD) delivery mechanisms.

UHD can be delivered over broadcast networks (DTT, DTH, cable and IPTV). For delivery over IP networks, either managed (IP QoS) or unmanaged (OTT), it is recommended to use an adaptive streaming protocol based on MPEG-DASH that makes all the different profiles available to the connected TV or the STB.

So, what will be the difference, from a standardization perspective, between the transport stream based specification (TS 101 154) and the DVB-DASH specification (TS 103 285)? Well, a primary goal of the update is to keep all technical decisions with respect to High Dynamic Range (HDR), Wide Color Gamut (WCG), High Frame Rate (HFR) and Next generation Audio (NGA) unchanged for the DVB-DASH specification, with a unicast delivery in mind. As a result, some of the tools developed for the TS applications might not be relevant.

In a DVB-DASH environment, backward compatibility with Phase 1 IRD (Integrated Receiver Decoder) could now, for instance, be addressed in a different way, as a copy of the same content in Phase 1 and Phase 2 formats could always be made available in unicast. In the same way for HFR, some profiles might be in 2160p100, next to 2160p50 lower resolution profiles. This approach could be easier to deploy but would, of course, cost more in terms of encoding, storage and networking.

One other characteristic of unicast is that for limited traffic events for live-over-IP networks, unicast can address early model connected TVs, which might have different HDR capabilities (HDR10, Dolby Vision, HLG, etc.) than current systems. Those devices could be directly addressed in unicast, and then when the traffic starts to scale, the operator could deploy a STB using either multicast (using the TS specification) or unicast (using the DVB-DASH specification), or eventually ABR Multicast (and a more restricted choice of HDR capabilities).

What will the DVB-DASH specification bring to the market? First, it will provide a standard way to carry UHD ABR over any IP network. In today's OTT space, each operator develops a proprietary app for targeted UHD TV. This models works for VoD but is hard to scale for live applications.

On the other hand, for a DVB Phase 2 IRD that can decode a TS stream, it will not be too difficult to also support DVB-DASH as the same technologies (WCG, HDR, HFR, NGA) will be used. Figure 2 represents the converged broadcast and IP DVB UHD-1 Phase 2 solution.

Thierry Fautier is Vice President of Video Strategy at Harmonic. Thierry is in charge of defining and driving the execution of the long-term strategy of Harmonic's video business. He is currently leading the Commercial Requirements for UHD ABR, as well as ABR Multicast in the DVB Commercial Module.

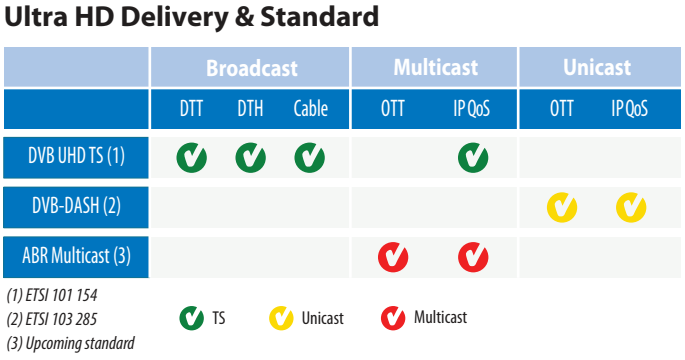
A live signal can be sent over a broadcast network to the DVB UHD-1 Phase 2 IRD. The live signal can also be sent over IP (QoS or OTT) to the DVB UHD-1 Phase 2 IRD. In addition, the on-demand signal (coming from VoD assets or catch-up TV) can also be streamed to the DVB UHD-1 Phase 2 IRD. With DVB-DASH UHD-1 Phase 2, a broadcaster can decide to send some content over broadcast using the TS specification (short tail) and the rest of the content using DVB-DASH specification in unicast (long tail).

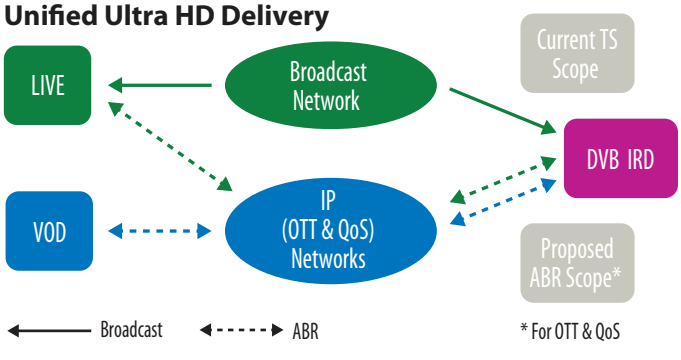
With its UHD-1 Phase 2 for TS and DASH specifications, DVB has defined a complete framework that can accommodate all the different network deliveries — broadcast, multicast and unicast — and is preparing for live scaling with its upcoming ABR Multicast specification.

The Commercial Module approved the UHD-1 Phase 2 UHD ABR Commercial Requirements in June 2016, and a DVB-DASH technical specification is expected before the end of the year.

Figure 1. DVB UHD standardization initiatives

Figure 2. DVB methods for delivering UHD-1 Phase 2





A New Era

Subtitling for UHD

Peter Cherriman, Chair, DVB TM-SUB

Peter Cherriman is a Senior R&D Engineer at the BBC Research and Development's London laboratory in the UK. His main areas of work include access services, PSI/SI signaling and digital television testing. He has been an active member of DVB for many years and currently chairs the subtitle technical working group TM-SUB.

New subtitling standards tend to appear rarely and the existing standards have a long life. There are two DVB subtitling standards in common usage today; both are around 20 years old.

EN 300 472 was first published in 1994; it defines the mechanism for carrying ITU-R System B Teletext subtitles (also known as EBU Teletext EN 300 706) within DVB transport streams. EN 300 472 enabled Teletext subtitles, as used in analog television to be used with digital television. The Teletext characters being rendered by fonts within the receiver or television.

EN 300 743 was first published in 1997, it defines a method by which subtitles, logos and other graphical elements are carried within a DVB transport stream. This specification took a different approach. At the time it was judged that there were several advantages to performing the font rendering at the broadcast headend and sending line-by-line bitmap representation of the subtitles to receivers. It reduced receiver costs since preinstallation of fonts for subtitling was no longer required. It also allowed the broadcasters to have closer control of the positioning and look of the subtitles. However the bitrate requirements for transmission are not constant, but variable and content dependent.

The first two revisions of the EN 300 743 specification were designed for standard definition digital television. In 2006 the EN 300 743 specification was updated to version 1.3.1 for HD television, allowing support of multiple HD formats including 1920x1080, 1440x1080, and 1280x720. The final two revisions of EN 300 743 (latest being v1.5.1) added support for subtitling plano-stereoscopic (i.e. 3D) television, by allowing the broadcaster to signal the disparity at which the subtitles should be displayed, so they appeared at a suitable depth.

Next Generation subtitles

In 2014 DVB started looking at commercial requirements for subtitles for Ultra High Definition TV (UHDTV). The existing subtitle specifications were now quite old, technology had moved on and a more efficient and flexible subtitle system was desirable for both current and future broadcast systems.

There was concern the bitrate requirements for bitmapped subtitles for UHDTV would be significant. It was felt a move back towards text-based subtitles was now possible since modern receivers included high quality font rendering engines for rendering web pages and user interfaces. While bitmap subtitles have to be rendered at the broadcaster headend for one particular resolution, text-based subtitles can be rendered at the optimal resolution for the graphic capabilities of each receiver/display. Text-based subtitles have other advantages: they could allow user customization (e.g., size, color) and are more easily converted to other formats, perhaps being used by text to speech engines in future receivers.

The commercial requirements produced required a bitrate efficient system suitable for use with SD, HD and UHD services. The solution needed to support compositing of subtitles which may be defined in a different color-space to the video. The solution also needed to support downloadable fonts via broadcast or the internet. The downloadable font feature enables receivers to acquire fonts "in the field" rather than having the fonts preinstalled.

Image courtesy of the BBC

Due to continued interest in bitmap subtitles in regions of the world that needed to support many languages and characters, in 2016, DVB produced a further set of commercial requirements concerning bitmap-based subtitles for UHDTV. These commercial requirements require a backward compatible update to the EN 300 743 specification. The requirements are expected to be delivered by specifying HD resolution subtitles on UHDTV services.

Ongoing Technical work

The DVB technical subtitling group (TM-SUB) that has been working on the text-based subtitle requirements has decided to use a TTML based format, either EBU-TT-D or the text profile of the recently published IMSC1 standard. DVB had previously adopted EBU-TT-D within the DVB profile of MPEG DASH (TS 103 285). TM-SUB is currently working towards a PES based encapsulation and signaling for DVB transport streams.

The work on a new revision of EN 300 743 is yet to start, but some ambiguities with the current specification have already been found and will be corrected with the update for UHDTV.

When do we plan to be finished?

The goal is to complete both specifications to meet both sets of commercial requirements in October 2016 to align with a new TS 101 154 specification. However the Subtitling Group within DVB is quite small, so this is a challenging deadline to meet. So the Group would welcome any additional help from members (particularly those with implementation experience of PES packetization or font rendering) in order to complete these important specifications.

DVB-S2X

Empirical Findings

The DVB-S2X standard was published as ETSI EN 302 307 Part 2 in October 2014. It offers improved flexibility and features for the core applications of DVB-S2, including Direct-To-Home (DTH), contribution, VSAT and DSNG, as well as for emerging markets, such as airborne, rail and other mobile forward links, with configurations capable of coping with deep transient atmospheric fading. The availability of professional equipment implementing S2X features followed shortly thereafter.

Recently Rai Research carried out laboratory tests of DVB-S2X implementations to verify the real hardware performance, in comparison to ideal simulations of EN 302 307. Tests were performed in AWGN channel and all DVB-S2 & DVB-S2X modulation and coding configurations (MODCODs) were measured. Roll-off has been set to 5%. For each MODCOD the C/N at the threshold identified as FER1 (Frame Error Rate) has been measured, with FER1 denoting the presence of less than 1 wrong frame in 1 minute. This threshold is very similar to the threshold of the error visibility (TOV) and, given the error correction capability of the LDPC codes, it is in close proximity (about 0.1 dB) to the QEF (Quasi Error Free) threshold (less than one error per hour of measurement) and in good alignment to the FER=10^{-5} threshold used for performance evaluations in EN 302 307 (Table 13 of EN 302 307-1 (DVB-S2) and Table 20a of EN 302 307-2 (DVB-S2X)).

The diagram shows, for both the simulated system and the hardware equipment, the maximum efficiency in bit/s/Hz that can be achieved for each C/N value. The figures show that the commercial implementations match very well the ideal simulations. The Implementation Margin (IM) is in the order of 0,1 dB for constellations up to 32APSK, becoming 0,2 dB for 64APSK and 0,3 dB for 256APSK (see the green square in the diagram).

The excellent performance of the DVB-S2X equipment available in the market makes the DVB standard a top system not only in theory, but also in practice. This adds a further important point to the already known reasons to choose DVB-S2X over proprietary solutions:

- State of the art performance
- Future proof system
- Adopted worldwide
- Hardware availability from several manufacturers around the world
- Hardware equipment performance matching ideal simulations.

Vittoria Mignone, Rai

Use Cases

DVB Member Newtec has had an instrumental role in the development and application of the DVB-S2X standard, utilizing it in its equipment since it was released in Q1 of 2014.

The improved efficiency it provides (see diagram) has given the satellite industry the opportunity for increased profitability and growth throughout a broad range of applications, particularly when combined with a flexible multiservice VSAT platform and High Throughput Satellites (HTS).

Let's explore some of the first DVB-S2X deployments.

Cellular Backhaul

A Tier 1 mobile operator in Latin America wanted to connect a 4G enB base station on an island to its core network on the mainland through a satellite connection. The traffic was already reaching over 100 Mbps with significant growth planned. The operator considered deploying this large trunk over MEO or more traditional GEO satellites, but the financial model proved very challenging.

DVB-S2X modems with on-board bandwidth cancellation technology, proposed by Newtec's certified business partner Axesat, provided a solution with utmost efficiency and minimal latency, allowing the mobile operator to reach the target price point per Mbps with the highest availability and performance, while leveraging a competitive GEO satellite.

Primary Distribution

Another example of where DVB-S2X has provided greater efficiency is in distribution networks. Huawei Technologies selected multi-carrier satellite gateways to upgrade a large satellite primary distribution network feeding content to hundreds of terrestrial DVB-T2 transmission sites. All the gateways use DVB-S2X, guaranteeing higher efficiency gains with advanced transmission technologies.

To further improve the economics, a multistream feature is allowing Huawei to optimize the transmission by combining multiple content streams on a single carrier per transponder.

As a result, DVB-S2X and other cost saving technologies can be applied to the combined carrier, maximizing efficiency and minimizing the equipment needed to receive the services at remote sites.

Maritime Networks

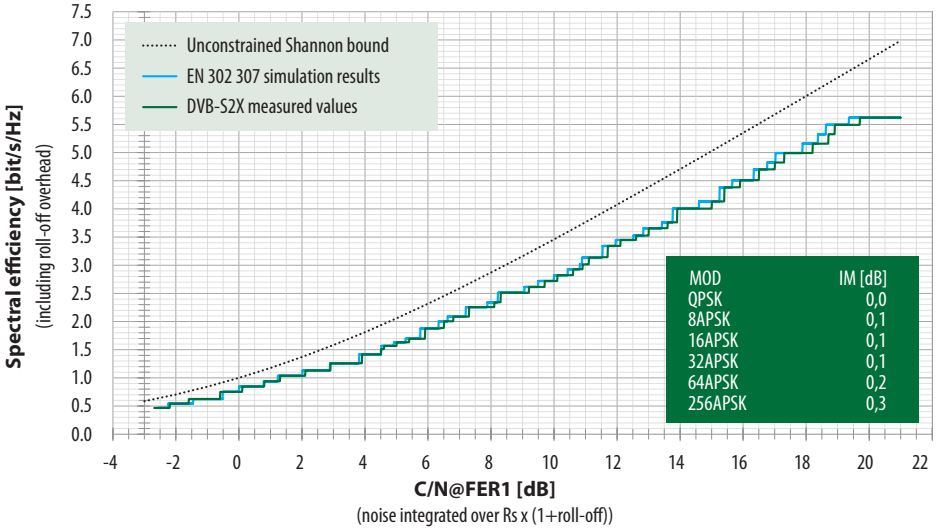
Maritime communication is another area in which DVB-S2X can support impressive gains. EMC, a leading maritime VSAT provider based in Miramar, Florida, is deploying satellite modems with DVB-S2X on some of the world's largest cruise ships and superyachts.

Today's cruising passengers and superyacht guests expect the same level of internet and entertainment access they have at home, often requiring up to 100Mbps per vessel. Using high-speed satellite modems with DVB-S2X allows EMC to maximize the benefit of next-generation High Throughput Satellites and deliver more bandwidth at unprecedented levels of efficiency and performance to meet this demand.

As these use cases illustrate, DVB-S2X represents a huge step forward in terms of efficiency, giving satellite service providers ever increasing flexibility with which to address new markets and applications.

Information courtesy of Newtec

DVB-S2X: Measured Values vs Theoretical Simulations (r=5%)



A Man Called Phil

A tribute to a retiring Chairman

David Wood

In many parts of our business just the first name 'Phil' alone has been enough to identify Philip Laven, the eight-year Chair of the DVB Steering Board and much else besides, who retired from the SB in June 2016. He has been a tremendous asset to the DVB Project over the past decade, and though surely biased by our friendship, I believe he, after fine predecessors, has been our greatest SB Chair yet. We are sorry to see him retire from DVB - but what must be, must be.

Phil and I were both at the BBC Research Department back in the days when people used to hum the Irish winners of the Eurovision Song Contest. We came into closer contact in the early 1990s, when Phil was Controller of Engineering of the BBC. He was there following DVB right at the beginning of the Project, and by the way, the hot topic of the time was an upcoming vote on Conditional Access.

A few years later, Phil joined the EBU as Technical Director, and I was loosely described as his left hand man. He followed in detail what happened in DVB. He always has a tremendous capacity for clear thinking and giving super presentations. I don't think his PowerPoint slide format has changed in all these years. But, hey, it was good. Maybe because of his birthplace, he has what some call 'Yorkshire directness'.

Phil retired early from the EBU in 2007, and as a Consultant to the EBU was persuaded to stand for Chair of the DVB Steering Board in 2008. This gave him the time to take good care of the Project. His term has seen some great achievements including DVB-T2, which is still the best digital broadcasting system in the world, and DVB-C2. I could mention so many other DVB achievements over the last eight years, but there is no need because you know them all.

Want one of the secrets of Phil? He is a world expert on a phenomena of nature called a 'Glory', which is a sort of complicated rainbow with a lot of maths. His charming Canadian wife, Willieann, has put up with a lot. Many thanks Phil (and Willieann), on behalf of the DVB Members (and the EBU), for very many years of fine service for the DVB and its ideals.

Are You Ready For DVB Asia 2016

Conference & Exhibition | 29 November - 1 December

Plans for the first DVB Asia Conference & Exhibition are well underway. Concentrating specifically on the region's digital TV needs, the 3-day DVB Asia Conference & Exhibition will be an unrivalled opportunity to meet leading DVB and industry experts who will provide a range of opinions and guidance on the transition to HD and UHD with emerging HDR and HFR and much more.

The event will open with a DVB-T2 Masterclass led by Professor Ulrich Reimers from the Technical University Braunschweig and former Chairman of DVB Technical Module from 1992 to 2012. Immediately following the conference there will be a workshop entitled "UHD – What you must know about HDR, HFR, and NGA" conducted by David Wood, Chairman DVB Commercial Module for UHDTV.

As well as DVB experts, DVB Asia will also include speakers from Akamai, Dolby, EBU, ENENSYS, Ericsson, Harmonic, HHI, Multichoice, NBTC, Rohde & Schwarz, SAT-IP Alliance, Samsung, Sony and TU Braunschweig who will bring us up to date on their strategies to deal with today's changing media landscape.

DVB Asia 2016 will feature a curated exhibition space adjacent to the main conference room. A number of leading companies have already booked spaces. If you are interested in exhibiting or availing of a sponsorship opportunity contact Eva Markvoort (markvoort@dvb.org).

The DVB Asia 2016 Conference and Exhibition will take place in InterContinental Hotel, Bangkok, Thailand on November 29 to December 1. Special room discounts have been arranged for DVB Asia delegates.

For more information, including the full program, visit the event website where you can also sign up for DVB Asia eNews to bring you regular updates on the event.
www.dvbasia.org

Don't delay – Book Now!

Stop Press...

DVB World 2017 Host City Announced

The location of next year's annual DVB World Conference & Exhibition has just been announced. DVB World 2017 will take place in Vienna from 13 – 15 March at the Hilton Vienna Danube Hotel. Save the date.

More information is available at:
www.dvbworld.org

Reflections

Forward & Back

Phil Laven

Having just stood down as DVB's Chairman after eight years, it is appropriate for me to reflect on the history of DVB.

If asked to identify DVB's success stories, most members of DVB would point to our basic transmission standards: the first generation (DVB-S, DVB-C, DVB-T) in the mid-1990s and the second generation (DVB-S2, DVB-C2, DVB-T2) some 10-15 years later. Obviously, DVB can be very proud that these standards have been so widely adopted across the world, but my personal view is that DVB's greatest success has been to stop "politicians picking winners". Before DVB, European politicians and regulators were desperately keen to mandate broadcasting standards through EU Directives (e.g., MAC, HD-MAC, PALplus) and set timetables for their adoption. DVB proved that it could achieve cross-industry consensus without any interference from politicians. Under EU law since 2003, governments and regulators are now required to be "technology-neutral". This ensures that investment decisions are made by market players, rather than by politicians – who, sadly, often have a feeble understanding of technology and, indeed, of business.

> ...much of the important work goes on in small sub-groups and the hard work of these unsung heroes is the fundamental reason for DVB's lasting success.

Nevertheless, there was a strange episode in 2007 when EU Commissioner Viviane Reding announced a plan to mandate DVB-H as the only system for mobile TV services in Europe. In these strange circumstances, DVB faced a dilemma. Should DVB actively oppose a powerful politician trying to encourage adoption of one of its own standards or should DVB abandon its opposition to the principle of mandation? After a few months, the EU plan to mandate DVB-H fell by the wayside, mainly because there were grave doubts about the business case for mobile TV. In retrospect, it is obvious that "interference" in this particular market would have proved acutely embarrassing for the EU. At the same time, it is important to recall that DVB-H's failure in the market was not due to technology issues, but because mobile network operators were reluctant to include DVB-H in their subsidized handsets.

More broadly, the market failures of DVB-H (and DVB-SH) must serve as a strong warning to avoid "technologies in search of an application". Despite DVB's insistence on technical developments being subservient to commercial requirements, it is not always possible to predict commercial success – if it were an easy task, many of us would be multimillionaires! The reality is that nine out of ten new products fail in the market. In my opinion, DVB can learn much more from its mistakes than from its successes.

Looking to the future, almost all of DVB's members will face increasing competition and, therefore, will need to become more agile and responsive to evolving situations. DVB cannot be immune to such pressures: it must become more efficient whilst maintaining its reputation for high quality and timely specifications.

Having been actively involved in DVB since 1993, I would like to pay tribute to the hundreds of talented individuals who have contributed in various ways to the success story of DVB. Much of DVB's most important work goes on in small sub-groups which often do not get the credit that they deserve. The hard work of these unsung heroes is the fundamental reason for DVB's lasting success.

Finally, I take this opportunity to congratulate Peter MacAvock on his election as my successor. Obviously, his long experience as DVB's Executive Director will be very valuable but, more importantly, I am confident that DVB will benefit from his strategic grasp of the opportunities and challenges facing DVB in the next few years.

Phil Laven

At the 83rd meeting of the Steering Board, **Peter MacAvock** was elected as DVB's new Chairman. Peter served as DVB's Executive Director for 14 years before taking his current position of Head of Delivery, Platforms and Services at EBU Technology & Innovation.

Peter takes over at an exciting time for DVB as it engages in the ongoing development of UHDTV with decisions on HDR, HFR and Next Generation Audio; future transmission systems; Study Mission Groups on Virtual Reality; amongst others. With the rising importance of OTT, Hybrid TV, and other methods of delivery, the DVB environment is changing, and DVB will adapt to meet the new challenges the TV industry is currently facing.

Commenting on his appointment, Peter MacAvock said, "I look forward to the challenges ahead. Chairing DVB is a huge honor, and it remains at the center of the way we do TV. DVB needs to stand on the shoulders of its past successes to prepare for an exciting future: no small challenge in today's ever changing environment."

African Progress

Digital Switchover

Marcello Lombardo, EBU

Marcello Lombardo is EBU's Spectrum Project Coordinator. He graduated in Electronic Engineering in Rome and is a PMI certified Project Management Professional. He joined the EBU in 2014 after several years of experience nurtured in companies like Ericsson, Bombardier and MBDA.

The Digital Broadcasting Africa Forum 2016 was organized by the Commonwealth Telecommunications Organization (CTO) and held 11-13 May in Lagos, Nigeria. The central theme of the three day conference was the switch-off of analog terrestrial television and the full roll-out of digital terrestrial television (DTT) in Africa, where many countries missed the initial deadline of 17 June 2015 set by the ITU. The event was officially opened by the Nigerian Minister of Information and Culture, Alhaji Lai Mohammed.

The forum was an occasion to share knowledge and expertise on the topic and the EBU contributed by giving insights on the public service broadcasters' perspective as well as the benefits that African countries can get by investing in this broadcast distribution platform.

The event was very well attended by national spectrum regulators who recognized the critical importance of a timely DTT implementation for both economic and social reasons.

Digital Terrestrial Television rollout requires a lengthy process and the collaboration of several stakeholders.

The experience in Europe shows that it is essential that the governments set a nationwide strategy and lead the process to the end. They of course need to include all relevant stakeholders. Without a clear plan and the buy-in of all the actors involved it is easy to fail.

As explained by delegates from Ghana, Malawi, Sierra Leone, Nigeria, Uganda and Kenya, the major roadblocks for the project were the lack of funding and the lack of clarity on how to subsidize set-top boxes to smooth the transition for the population. Once these problems are overcome it will probably be easier to kick off a public awareness campaign to prepare the switch-off of analog television that is now supposed to happen in June 2017.

Regarding the choice of technology, all regulators were united on DVB-T2/MPEG-4. The opportunity for African countries is to skip one technology step and deploy the latest mature technology available and reduce the gap with European countries which are discussing now, with few exceptions, the transition from DVB-T to DVB-T2. A clear example of this choice was provided by the Kenyan regulator, where the first DTT pilot in Kenya started in 2007 with DVB-T/MPEG-4, but three years later it was decided to focus all the efforts on DVB-T2/MPEG4 given the increased maturity of the latter.

Regarding the terrestrial television network, it was explained, as in Europe, broadcasters are no longer network operators but content providers. The network is therefore managed by external companies. At the current time, more than one year away from the new deadline, both the population and geographic coverage for DTT is already higher than analog TV. The most advanced countries are Ghana with more than 95% population coverage and Malawi with 55% population coverage.

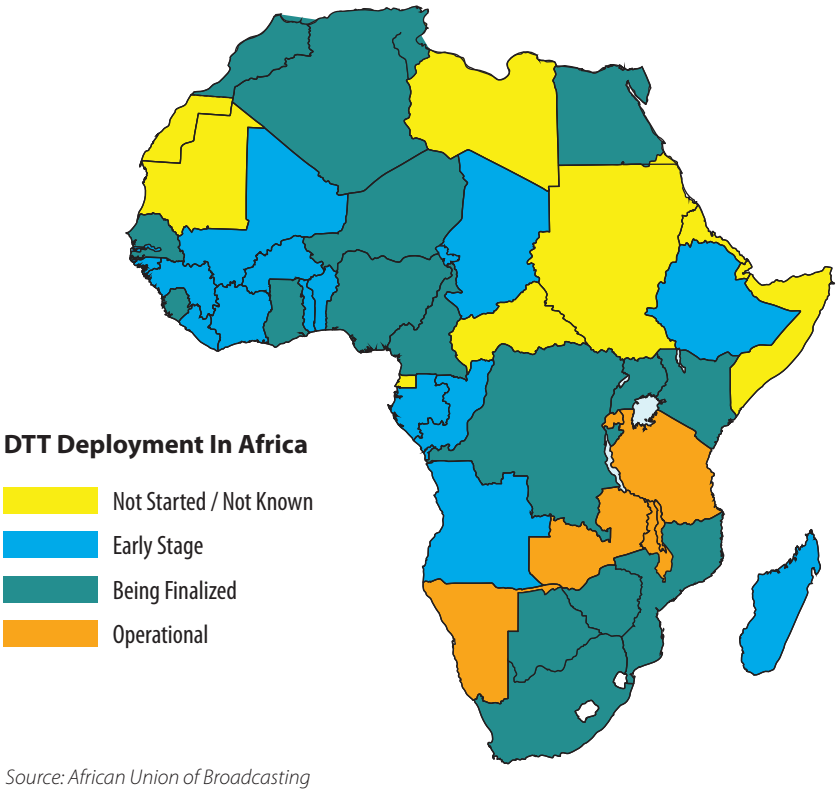
With the choice of DVB-T2/MPEG-4 and the increased capacity available for a MUX, the attention has now moved onto content production to fill those MUXes with new services. There is an impetus to create locally produced content, which will represent the major source of GDP contribution and job creation.

Local content production drives the creation of a vibrant local economy and DTT, with its identity strictly tied to the territory, is the cornerstone of this environment as it reinforces the national and cultural identity for those countries that have been flooded in the past with foreign content.

In the end, the awareness level on the value that DTT and DVB-T2/MPEG-4 can bring is clear and it is also clear that WRC-15 with the decision to maintain the exclusive allocation of the 470-694 MHz band to broadcasting for the foreseeable future (with a review in WRC-23), set the right conditions to speed up the digital switchover process.

DTT is a low hanging fruit for the taking.

DTT Deployment In Africa



Source: African Union of Broadcasting

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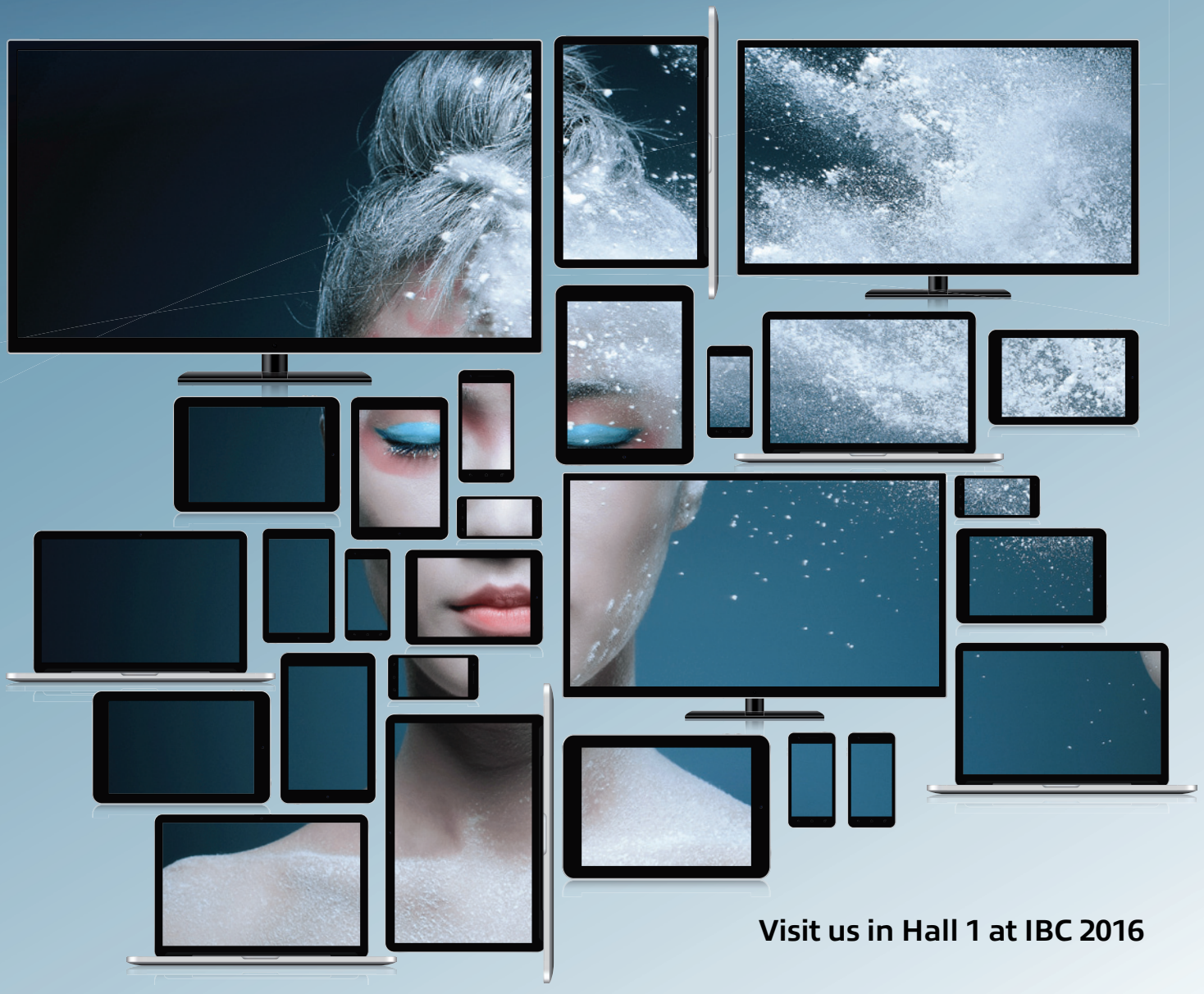

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