DVBSCENE

DVB

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A word from the DVB Project Office

Two years ago, in this very column, I proudly announced that DVB had finalized its work on UHD Phase 2. "A small step for mankind, but a big step for the broadcast industry," was how I described it at the time. With Phase 1 having included 4k resolution and Wide Colour Gamut (WCG), the update to TS 101 154 added three exciting new features: High Dynamic Range (HDR), High Frame Rate (HFR) and Next Generation Audio (NGA).

I predicted at that time that it would take some time for the broadcast industry to understand and implement these technologies. What we have seen is that display manufacturers were the first to move, adding all of these enhancements with the exception of HFR. You can now purchase TV sets with crisp 4k images and an impressive range of colours and contrasts. Additionally, more and more consumer equipment can provide highly immersive audio experiences. So, the end-user devices are there, but where is the content?

I'm happy to see that broadcasters are also following DVB's standards, with concrete plans for UHD Phase 1 features. There are plans in France to introduce UHD on the DTT platform, as well as enhancing HD with HFR-HDR-WCG-NGA. This enhanced HD format will provide a significant step forward for the user compared to the commonly used 1080i format, with only a minor increase in the data rate.

Elsewhere in Europe, Italy is considering a similar route, testing both UHD and enhanced HD, while the latest NorDig specification adds NGA to the already specified image enhancements. It has taken some time but the complete ecosystem for DVB's UHD specification suite is coming together.

In the meantime, DVB has set sail for somewhat uncharted territories. With DVB-I we will bring the broadcast user experience and Quality of Experience to OTT delivery of television content. This will bring television to a wider range of new devices like tablets and smartphones.

You can read about all of this – and more – in the pages that follow.

Peter Siebert
Head of Technology, DVB Project

See you in Dublin?
11-13 March

DVB WORLD 2019

5G, OTT, DVB-I, HbbTV and more...

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DVB News

New PCM chair

Stan Baaijens, CEO of Netherlands-based DVB Member Funke Digital TV, became chair of DVB's Promotion and Communications Module (PCM) after IBC 2018. Stan replaced Helmut Stein, who had been in the role since the creation of the DVB Project.

The PCM is open to all Members. It meets several times a year to plan DVB's participation in trade shows, workshops and conferences, and to coordinate communication about DVB specifications.

NEW MEMBERS

MediaKind is a provider of DVB-compliant headends, receivers and platforms. It was formerly known as Ericsson Media Services.
www.mediakind.com

Ikusi Electronica, S.L., part of the Spain-based IKUSI group, develops solutions for for operators, installers, integrators and distributors of professional electronic equipment.
www.ikusi.com

SECO S.p.A., based in Italy, works in the field of high technology and miniaturization of computers. SECO engages in hardware and software integration of digital tuners, particularly for terrestrial broadcasting.
www.seco.com

See you in Vegas?

DVB will exhibit at the NAB Show this year for the first time since 2010. Our booth will be in the Connected Media IP zone, in the South Upper Hall, where we'll be talking to visitors about the DVB-I initiative and our work to bring the best features of broadcast TV to television over the internet, whether as part of a hybrid offering, IPTV or standalone OTT.

Find us at stand #SU8724 • 8-11 April, Las Vegas

NEW STANDARDS

EN 300 743 V1.6.1: DVB Subtitling systems (October 2018)

TS 103 605 V1.1.1: Second Generation Common Interface (CI); Implementation Using the Universal Serial Bus (USB) (October 2018)

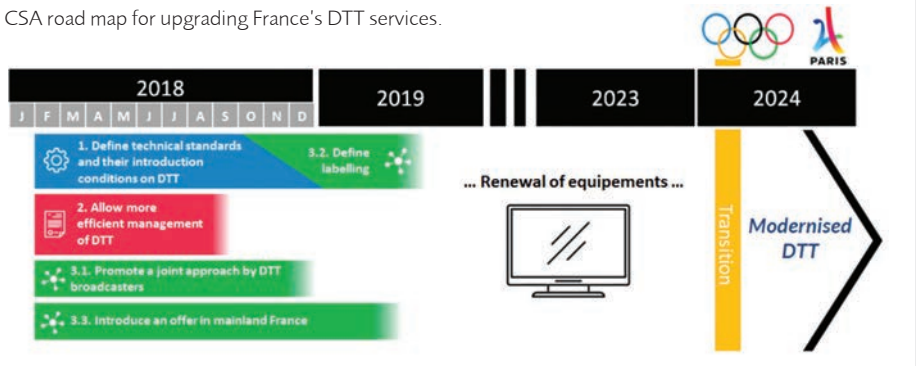
TS 101 154 V2.5.1: Specification for the use of Video and Audio Coding in Broadcast and Broadband Applications (January 2019)

Join our next FREE webinar on 18 March at 15:00 CET.

Next Generation Audio in DVB systems

Presenter: Simon Tuff, Portfolio Partner, BBC Design+Engineering

En route for next generation DTT in France



CSA road map for upgrading France's DTT services.

Since its launch in 2005, the dynamic French DTT (digital terrestrial television) platform has constantly kept pace with the latest technology developments in order to meet TV viewers' ever-growing expectations.

Despite the high penetration of IPTV, driven by telecoms operators' triple-play package offers, DTT is still the dominant method French people use for receiving television. Nearly two thirds of homes use it on their main and/or second TV sets, and even via IPTV set-top boxes, all of which include a DTT input. Indeed, it is the platform that acts as the backbone of the French media landscape, guaranteeing universal, free, anonymous and user-friendly television access for virtually the entire population (with DTT coverage of 97 per cent).

THE ROAD TO PARIS 2024

In April 2016, an image quality upgrade was completed on the DVB-T network, with the transition to full HD using the MPEG-4 standard. Looking ahead to the 2024 Paris Olympics, the DTT platform is now preparing for a new phase of modernization, with a view to improving the audio and image offer via a transition to the DVB-T2 / HEVC standards. The development of interactive services based on the HbbTV standard will also be boosted. The CSA (French media regulatory authority) is overseeing the work and in February 2018, following a consultation process involving all parties, a road map was released.

Within the FAVN (Forum AudioVisuel Numérique), an association bringing together audiovisual industry professionals including television channels, manufacturers, broadcasters, distributors and institutional partners, working groups are currently finalizing image and audio standards, an interactive services standard, and the DVB-T2/HEVC-based transmission and coding standards. FAVN groups are also ensuring product compatibility across all TV sets and working out how to roll out all this advanced technology on DTT. The work focuses particularly on feedback from trials carried out over several years involving television channels, TDF and manufacturers. An experimental multiplex has been broadcasting across the Paris single frequency network – comprising transmission sites at the Eiffel Tower, Chennevières, Meaux and Chaville – and in two regional cities, Nantes and Toulouse.

NEW FORMATS

The switch to DVB-T2/HEVC broadcasting is planned for the first quarter of 2024 at the latest. The spectrum efficiency boost (up to around 2.7 times) compared to the current DVB-T/MPEG-4 configuration will enable the introduction of UHD resolution, enhanced HD images (with higher frame rates and dynamic range and improved colours) and Next Generation Audio formats.

However, despite this significant improvement, the existing 32 national and 40 regional DTT channels will not all be able to upgrade to UHD at the same time.

So work is also being planned to define new rules to bring about more efficient and dynamic frequency management.

An additional multi-town multiplex – a so-called "precursor" – is also being evaluated, to promote the upgraded DTT platform to the public and increase household penetration of compatible TV sets.

Modernizing DTT in this way is a big leap forward with a view to ensuring that this universal television viewing platform, which the French appreciate so much, remains an attractive option in the face of competition from IPTV and OTT video platforms. En route for DVB-T2, HEVC and UHD in France!

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WORKING GROUPS ARE CURRENTLY FINALIZING IMAGE AND AUDIO STANDARDS, AN INTERACTIVE SERVICES STANDARD, AND THE DVB-T2/HEVC-BASED TRANSMISSION AND CODING STANDARDS

Gaelle Kaminsky is the Head of Development and Sales Support in the Audiovisual Business Unit at TDF. She is also active in several working groups of the FAVN (Forum AudioVisuel Numérique).

CLAUS PFEIFER, SONY

Towards 2022 in Italy: technology options tested during European Athletics Championships

DVB-T2 and HEVC are the candidate technologies to complement or replace the current DVB-T MPEG-2 SD / MPEG-4 HD terrestrial format in Italy after the release of the 700 MHz band in 2022. Their introduction would compensate for the reduction of available spectrum resources thanks to their higher efficiency.

To prepare for such an evolution, DVB-T2 and HEVC have been legally mandated for new TV sets and decoders in Italy since 2017. Pending final political decisions (regarding spectrum re-farming, capacity allocation to broadcasters, mandated technologies and consumer subsidies to facilitate technology migration), the national broadcaster Rai has been testing the various technology options to upgrade its existing 13 programmes to Full HD, including the possibility of dedicating a portion of the future terrestrial capacity to UHD services.

PUSHING THE LIMITS

DVB's UHD-1 phase 2 specification includes five ways in which HDTV can be improved: image resolution (UHD), dynamic range (HDR), colour gamut (WCG), frame rate (HFR) and immersive personalized sound (NGA). During the European Athletics Championships in August 2018, representatives of several EBU Members and 20 industry partners took part in an effort to put all of this in practice for a live production. Testing, for the first time, HFR mode during a live sports event enabled assessment of its impact on image resolution and motion blur during highly dynamic scenes. (The December 2018 issue of the EBU's tech-*i* magazine provides information on the technical parameters and equipment used. See: tech.ebu.ch/tech-i)

For Rai this was an opportunity to demonstrate the feasibility of live terrestrial broadcasting at the highest quality currently possible for DVB video and audio technologies: UHD/4k with HDR and HFR HEVC video along with NGA. The test was conducted via the experimental DVB-T2 terrestrial network in the Aosta Valley.

The service mux was composed of the UHD HDR HFR video signal encoded in HEVC at 25 Mb/s in single PID mode, along with a down-converted HD version encoded at 12 Mb/s 1080p100 HDR, to allow direct comparison.

The MPEG Transport Stream was sent to Aosta via a DVB-S2 satellite link, where it was broadcast on the Raiway experimental DVB-T2 network, covering most of the Aosta Valley by means of five SFN transmitters on UHF channel 53.

While several DVB-T2 modes were tested, the basic parameters were 256 QAM modulation with a 2/3 code rate and Guard Interval of 1/16.

ENHANCED HD VS. UHD

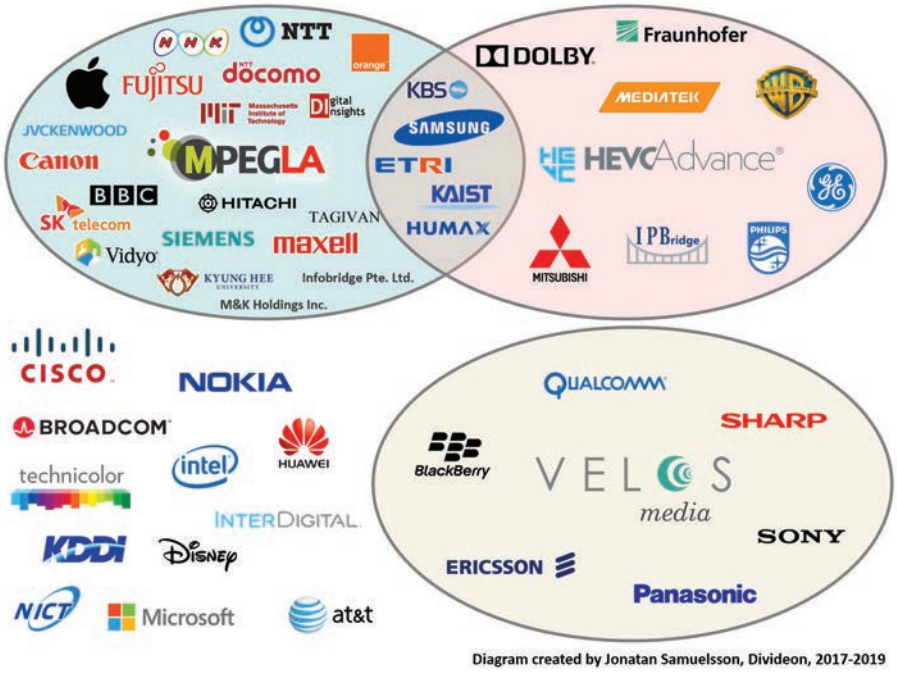
In the Rai facility in Aosta a reception and viewing point was equipped with an LG TV set able to display 100 Hz UHD pictures. Two different audio setups were used: one based on a prototype soundbar able to reproduce an immersive sound field and a second based on more traditional loudspeakers.

Guests who attended the demo were impressed by the quality of the pictures and sound. Even if UHD provided the highest quality, the HD version was also highly appreciated and was considered a significant step forward compared to the present 1080i format. The NGA features were also judged very important for the success of a new transmission format.

It should be noted that the Rai4k programme is already available to Italian citizens by satellite from Tivùsat. It is now regularly re-broadcast free-to-air in the Aosta Valley on the experimental DVB-T2 network.

Alberto Morello is the Director of the Research Centre of Rai, the Italian public broadcaster. He chaired the working groups that defined the DVB-DSNG and DVB-S/S2/S2X systems and represents Rai on the DVB Steering Board.

Video coding developments in a multi-codec world



HEVC patent-holders

The video compression industry has become used to a regular pattern of key milestones: once per decade a new video coding standard has been developed that offers approximately twice the coding efficiency of the previous one. MPEG-2, the first generic video compression standard to be widely adopted, was developed in the early 1990s. H.264/AVC, offering the same subjective quality at about half the bit rate, was developed in the early 2000s. HEVC, giving a further factor of two improvement in compression efficiency, was developed in the early 2010s.

However, this pattern of one dominant video codec per decade now appears to be changing, as we move into a more complex, multi-codec world.

FROM HEVC TO VVC?

Each of the standards mentioned above was developed through collaboration between the same two standardization bodies: ISO/IEC MPEG and ITU-T VCEG. These two bodies are now working together again on a new video coding standard, known as Versatile Video Coding (VVC). Responses to a Call for Proposals were analyzed at a meeting in April 2018, with some proposals demonstrating compression efficiency gains of about 40% compared to HEVC.

The goal for the development of VVC is to provide yet another factor of two improvement in compression performance compared to HEVC, with a target completion date in October 2020. As of the MPEG meeting in January 2019, the technical work appears to be on target.

However, the commercial environment for VVC is more uncertain, since experience with HEVC has caused many segments of the potential user community to doubt the ability of some licence holders to publish clear licensing terms in a timely manner. Six years after the HEVC standard was finalized, it is still impossible to create a business plan with an accurate estimate of the total licensing cost without signing multiple NDAs and expending considerable effort in commercial discussions. HEVC licenses are required from three patent pools: MPEG LA, HEVC Advance and Velos Media. In addition, there are many likely HEVC IP holders who are not members of any of the three pools and who have not made their licensing terms public, as illustrated in the diagram to the left (reproduced with the kind permission of Divideon).

A NEW ENTRANT: AV1

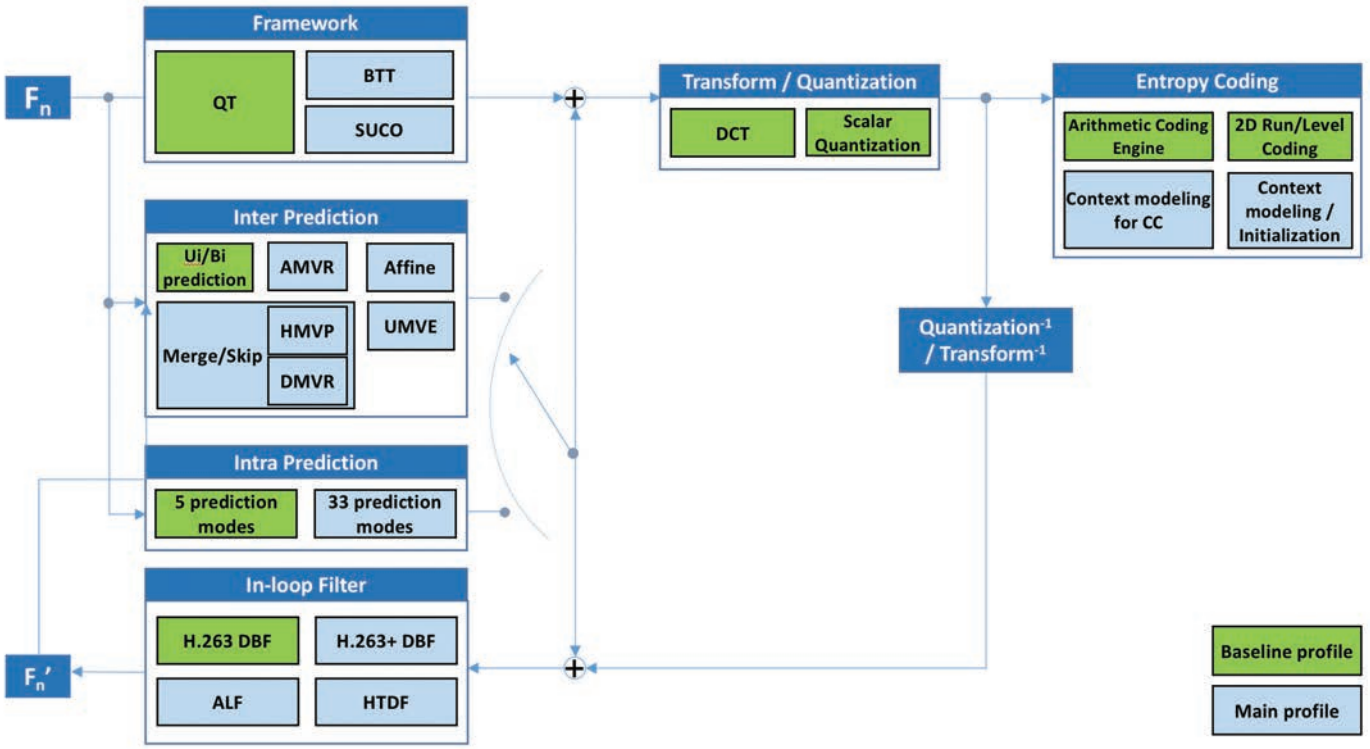
The complex licensing structure for HEVC has caused some key market segments, such as video streaming, to be reluctant to implement it. The Alliance for Open Media identified this gap in the market and has sought to fill it with the AV1 specification, which is claimed to be royalty-free. AV1 is supported by some major technology companies: the founding members are Amazon, Apple, ARM, Cisco, Facebook, Google, IBM, Intel, Microsoft, Mozilla, Netflix, and Nvidia.

There is still a shortage of well-conducted, neutral comparisons of the compression efficiency of AV1 and HEVC, but they seem to be roughly comparable in terms of compression efficiency. However, AV1 appears to require a significantly more complex encoder in order to achieve this performance, so it may be more difficult to use for real-time applications.

The desire to improve the real-world adoption of MPEG standards, by reassuring potential users that the licensing mistakes of HEVC will not be repeated, has led several industry players to get together and form the Media Coding Industry Forum (MC-IF). This provides a forum where members from different parts of the video compression ecosystem can meet to discuss and resolve a broad range of potential barriers to the deployment of MPEG standards, with an initial focus on VVC. The first board of directors of MC-IF was elected in January 2019, with directors from

Ken McCann is a director and co-founder of Zetacast, an independent technology consultancy that specializes in providing standardization and regulatory support services to the consumer electronics, multimedia and broadcasting industries. Ken was chair of DVB TM-AVC from 1997 until 2017.

MPEG-5 EVC diagram



Apple, CableLabs, Divideon, Ericsson, Intel, InterDigital, Nokia, Orange and Tencent. The work of MC-IF is intended to be complementary to that of the standardization bodies themselves and it may include consideration of licensing issues that go beyond the scope of activities allowed by the Common Patent Policy for ITU-T, ITU-R, ISO and IEC.

MPEG-5: ONLY THE ESSENTIALS?

In a further development, MPEG itself has recognized the requirement to create a new standard that has a higher probability of addressing business needs in use cases where existing MPEG video coding standards have not been as widely deployed as might be expected from purely technical considerations. At the October 2018 MPEG meeting, MPEG issued a Call for Proposals for a new video coding standard to be developed using a streamlined process. This standard has subsequently become known as MPEG-5 Essential Video Coding (EVC).

MPEG-5 EVC will include a Baseline profile that contains only technologies that are over 20 years old or are otherwise expected to be royalty-free. A Main profile will add a small number of additional tools, without these constraints. Each of these additional tools is individually capable of being either cleanly switched off or else cleanly switched over to the corresponding Baseline tool. This capability is intended to make it easier for an MPEG "customer" organization, such as DVB, to define its own profile. A future DVB profile could be optimized to meet both commercial and technical requirements for DVB-compliant applications, e.g. by omitting any Main profile tools that may be found to be problematic to implement.

The January 2019 MPEG meeting evaluated the responses to the Call for Proposals for EVC and produced an initial test model, which is illustrated in the simplified block diagram above.

The main functions are the framework for block partitioning, inter-picture prediction, intra-picture prediction, in-loop filtering, the block transform and quantization, and entropy coding. Within each of these functions, the tools in the Baseline profile are shown in green. The additional tools in the Main profile are shown in light blue; each Main profile tool can each be either switched off or else switched over to the corresponding Baseline tool, on an individual basis. With the Main profile tools all turned on, the compression performance was measured to be approximately 24% better than HEVC.

The tools in the initial MPEG-5 EVC test model are based on a three-company response to the Call for Proposals from Samsung Electronics, Huawei and Qualcomm. The proponents of this proposal have made a commitment to publish the licensing terms for their Main Profile tools within two years of completion of the standard, to help potential users to create business plans as early as possible. The development of the MPEG-5 EVC standard is expected to be completed in early 2020.

THIS PATTERN OF ONE DOMINANT VIDEO CODEC PER DECADE NOW APPEARS TO BE CHANGING, AS WE MOVE INTO A MORE COMPLEX, MULTI-CODEC WORLD.

DVB-I: television without limits

DVB-I is an ongoing initiative to develop technical standards for delivering television services over IP, primarily meaning over-the-top, over the internet. As the work has recently moved from DVB's Commercial to its Technical Module, now is a good time to provide an update on progress.

DVB-I will stand alongside the existing DVB-T (terrestrial), DVB-S (satellite) and DVB-C (cable) broadcast standards and for users, the experience of accessing services should be the same regardless of which delivery channel is used. DVB-I deployments can be stand-alone, or broadcast and IP delivery can be combined to create a single hybrid offering. The latter would incorporate services delivered via both methods, making optimal use of the different characteristics of each channel. Benefits will also include:

- Services will be available to users who don't have access to broadcast television
- Services will be available on devices that don't include DVB tuners
- New services can be offered that would not be viable on a traditional broadcast platform

WHY DVB-I?

Of course, much of this is possible today using, for example, Android or iOS applications, but these provide a very different user experience to a traditional DVB receiver. While taking advantage of the internet as a distribution platform, DVB-I will allow the best features of broadcast television that have evolved over decades of television viewing – such as the integrated channel list, the content guide, and simple "lean back" channel selection – to be brought in this new world. It will also bring the advantages of a standardized solution, with the scale and cost savings that offers. With DVB-I services, the user will not have to care, or even be aware, whether a service reaches them via broadcast or IP.

While DVB-I aims to offer equivalent functionality to broadcast, it will not be limited by the capabilities of broadcast. DVB-I will allow broadcasters to take advantage of the unique capabilities of IP delivery, both technically and commercially. This means that as well as linear television, video-on-demand will be supported. Broadcasters will also be able to offer different versions of a service, targeting different groups of users in a way that is not feasible with broadcast. Some examples of the kinds of service this will enable include the provision of accessibility options such video with signing, or versions of content with special technical characteristics such as UHD resolution.

As mentioned above, another important feature that DVB-I will offer is the ability to deploy to receivers a single integrated service list including services available over both broadcast and IP. Many DVB-I receivers, such as TV sets, will include broadcast receivers, and some broadcasters are expected to deploy services in a hybrid manner. In such a model, some services are carried over DVB-T, C or S, which may be the most efficient distribution method for the most-watched services, while more niche, "long tail" services are provided via IP. This can also be combined with the ability to offer different versions of services, meaning that, depending on a user's preferences and the technical capabilities of their receiver, a service might be delivered to them via either broadcast or IP in a transparent manner.

CREATING THE SPECS

DVB's process involves first developing commercial requirements, and secondly defining a standard technical solution that meets those requirements. The

IN TERMS OF MAKING DVB-I FUNCTIONALLY EQUIVALENT TO DVB-T, C AND S, THE MAJOR MISSING PIECE FROM A STANDARDS PERSPECTIVE IS A SERVICE LAYER.

Peter Lanigan is Senior Manager – Standardization at TP Vision. He is the chair of the DVB Commercial Module's working group CM-I. .

WORK ON THE TECHNICAL SPECIFICATIONS IS NOW WELL UNDER WAY IN DVB, WITH MANY ACTIVE CONTRIBUTORS FROM ACROSS THE INDUSTRY.

commercial requirements for DVB-I were approved by the DVB Steering Board in August 2018 (with a subsequent update in November). The Technical Module has started work on developing the technical specifications based on these requirements, and DVB is expecting to publish a first specification in the course of 2019.

For much of the functionality required by DVB-I, good technical standards are already available. Content delivery will use the DVB-DASH specification which is already deployed by many broadcasters, often in conjunction with HbbTV. DVB is in the process of adding a low latency mode to DVB-DASH, to better support linear television services, and this will also be supported. In addition, the forthcoming DVB specification on Multicast Adaptive Bit Rate (mABR) will offer opportunities for broadcasters and network operators to work together to optimize delivery to large numbers of receivers simultaneously.

SERVICE LAYER

In terms of making DVB-I functionally equivalent to DVB-T, C and S, the major missing piece from a standards perspective is a service layer. This is used to signal the services and content that are available, meaning the information used by a TV set (or smartphone, tablet, app, etc.) to populate the channel list and the electronic programme guide. Conceptually it is equivalent to the SI and PSI information carried in a broadcast MPEG-2 Transport Stream. This will probably involve the most significant technical choices for the DVB TM in writing the DVB-I specifications. Several existing technologies are candidates to be adopted and, if necessary, extended to fulfil the requirements.

One challenge that the TM will have to solve is how a receiver starts the process of service discovery and locates the service list. When a receiver is connected to a terrestrial or satellite antenna, it performs a channel scan to find what services are available over a set of well-defined frequencies. This kind of approach is not feasible with the internet, where even if a similar scan was possible, many thousands of services would potentially be found.

A solution is needed which will allow the receiver to locate services relevant to the user, possibly based on geographical location, language, genre, etc. One simple solution is to leave this to the market to solve. Another could be for a central authority in each country to provide a service list, and for receivers to be pre-provisioned with the URLs of those lists. However, such an authority may not be available in all countries, and this approach does not fit well with all deployment scenarios, especially those of a more open nature.

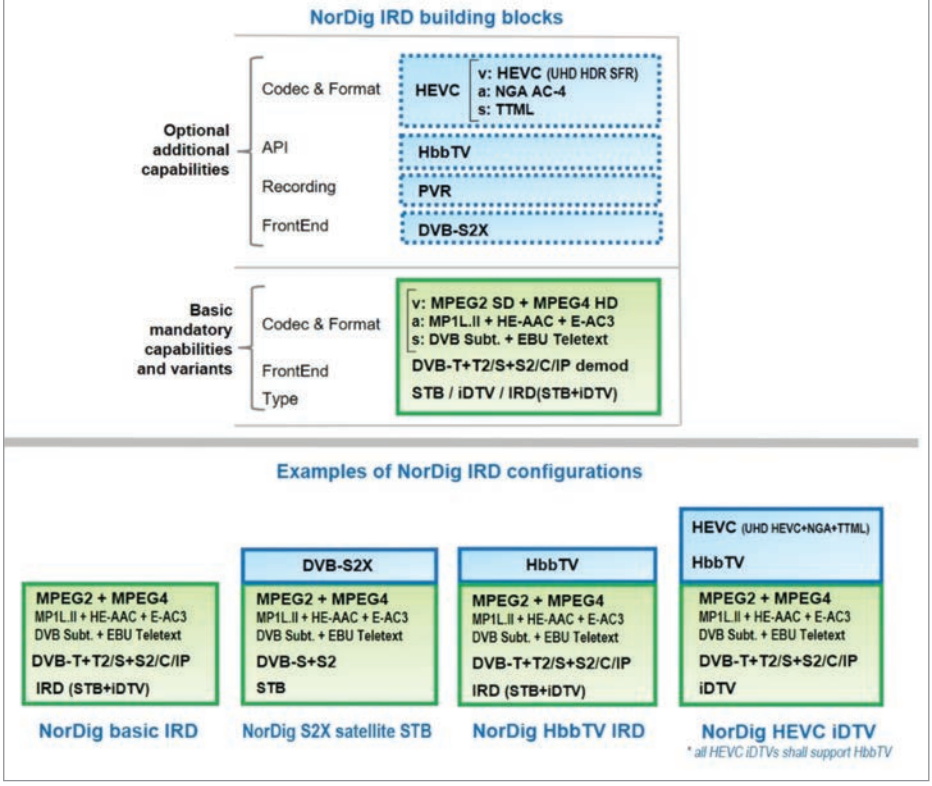
DVB is considering whether there are other possibilities that might avoid the need for country or broadcaster-specific solutions. At least, we need to avoid that the user has to enter a URL themselves.

GET INVOLVED!

Work on the technical specifications is now well under way in DVB, with many active contributors from across the industry. It is also likely that further requirements will emerge and be taken up by DVB in due course, and that new versions of the DVB-I specifications will be released. Some possibilities include further integration with broadcast services, or the use of DVB-I with 5G. The direction will, of course, be decided by DVB's Members, and interested readers are encouraged to participate in the work and to help shape the future of DVB-I.

NorDig receiver spec adds Next Generation Audio

NorDig timeline for the HEVC and NGA selection process and grace period / sunrise for HEVC IRD to support NGA.



In October 2018, NorDig released a new update of its Unified Requirements IRD (Integrated Digital Receiver) specification. The main updates in version 3.1, compared to the previous version 3.0 (2017), were: NGA (Next Generation Audio) decoding based on the Dolby AC-4 audio codec, HbbTV updated to v2.0.2, optional DVB-S2X, and additional security requirements for HEVC-based services based on CI+ ECP.

NGA is now a mandatory requirement for future HEVC receivers in the NorDig specifications. In choosing AC-4, NorDig has become one of the first regional specification organizations in Europe to support an NGA codec.

The process of making the decision to select both HEVC and NGA with AC-4 took two to three years in NorDig. The new NGA requirements, together with previously specified HEVC video and DVB TTML subtitling requirements, now make the requirements complete for the reception of HEVC-based services, all in accordance with DVB specifications.

DEFINING THE 3RD GENERATION IRD

NorDig started the study work for the third generation of TV services (HEVC-based) in late 2015, starting with a survey among members and the establishment of commercial requirements. It was apparent that the excepted lifespan of a new profile was to be long (10 years or more) and that it needed to be a significant step forward compared to the existing MPEG-4 HD based profile in order to be justified. The commercial requirements stated that the duplication of tools or codecs fulfilling the same commercial requirement should be avoided, i.e. no toolbox approach unless necessary.

For the video part this meant specifying a single HEVC profile and handling up to UHD resolution, HDR (High Dynamic Range) and WCG (Wide Colour Gamut). DVB's latest specification for subtitling, TTML, was also added to allow for the potential of a common format to be used for DVB broadcasting and the same content over OTT.

For the audio parts the interest among members was more for improving accessibility features than for extending normal audio above the 5.1 multichannel format. The NorDig Technical Committee did not believe it was realistic to use existing second generation audio codecs (HE-AAC and E-AC-3) to further improve the accessibility handling – for this NGA would be needed. DVB had, at that point, two good NGA audio codec candidates* and NorDig "just" needed to select one of them to avoid specifying an NGA toolbox.

"The process of selecting an NGA codec was complex and needed more time than the other parts," says Olli Sipilä chair of the Executive committee. "One of the most complex items inside NorDig organization so far, was to find a solution all members could accept."

CHOOSING A CODEC:

The NorDig Audio Subgroup worked hard on the background investigation of the two NGA codec candidates, AC-4 and MPEG-H audio. Johan Lindroos,

NEXT GENERATION AUDIO IS NOW A MANDATORY REQUIREMENT FOR FUTURE HEVC RECEIVERS IN THE NORDIG SPECIFICATIONS.

Per Tullstedt is Senior Systems Architect TV at Teracom AB and is Chair of the NorDig Technical Committee.

Building blocks for NorDig Unified v3.1 spec.

EVEN THOUGH NORDIG SELECTED AC-4, ITS NGA REQUIREMENTS ARE DESIGNED TO BE CODEC-AGNOSTIC

who chairs the Audio Subgroup, recalls that initially there were quite some misunderstandings of what NGA was and what it requires. "The audio experts needed to educate and to demystify NGA technology among NorDig members; for example, the fact that NGA does not require object-based audio playout. Broadcasters can start with their classical channel-based playout and later introduce object-based audio."

Use cases were defined in order to specify the audio implementation requirements, which took a lot of time and effort from all involved. Johan Lindroos was very grateful that NorDig received such enthusiastic cooperation and support from the companies representing the two NGA alternatives throughout the whole process. The big TV manufacturers were also supportive.

NON-TECHNICAL REASONS

Both codec candidates fulfilled NorDig's commercial requirements and real demonstrations were held with both. NorDig listed technical, commercial and other facts and features of the two codecs so that they could be compared. In the evaluation, the two codecs were found to be very equal and, in the end, it was mainly non-technical reasons behind the NorDig Executive Committee's decision for AC-4. Among these were the lack of an additional licence fee for already equipment that already supported Dolby Audio and the support for AC-4 in most future consumer devices.

In the end, NorDig defined the following audio format as Next Generation Audio, NGA: AC-4, which refers to AC-4 as defined in ETSI TS 103 190-2 and ETSI TS 101 154 (the latter being DVB's audio and video coding guidelines).

Johan Lindroos says that, even though NorDig selected AC-4, its NGA requirements are designed to be codec-agnostic. Much of NorDig's audio requirements are about the handling of signalling and audio prioritization, which required extra attention when adding NGA since it differs in these parts to previous codecs. For example, one NGA stream can carry multiple languages and formats. In previous audio formats, several legacy receiver behaviours and limitations had to be accounted for. With the new NGA this could be corrected.

**The most recent revision of TS 101 154 has added DTS-UHD alongside MPEG-H Audio and AC-4 as NGA codec options.*

WHAT IS NORDIG?

NorDig is a non-profit cooperative organization consisting initially of Nordic and Irish television companies and network operators, international receiver manufacturers, tech labs and associations; in all about 38 members and partners.

NorDig specifies a common platform for digital television to be used within the Nordic region (Denmark, Finland, Iceland, Norway, Sweden) and the Republic of Ireland. The NorDig specifications are also used in several countries and platforms outside the NorDig members.

NorDig is an open specification free to use. You can find and download all specifications via the website: www.nordig.org

Bringing DVB-T2 to the Raspberry Pi

Since being launched in 2012, Raspberry Pi has sold over 25 million of its low-cost general-purpose computers. Originally intended to help young people learn computer programming, they have found homes in a wide variety of hobbyist, commercial and industrial applications.

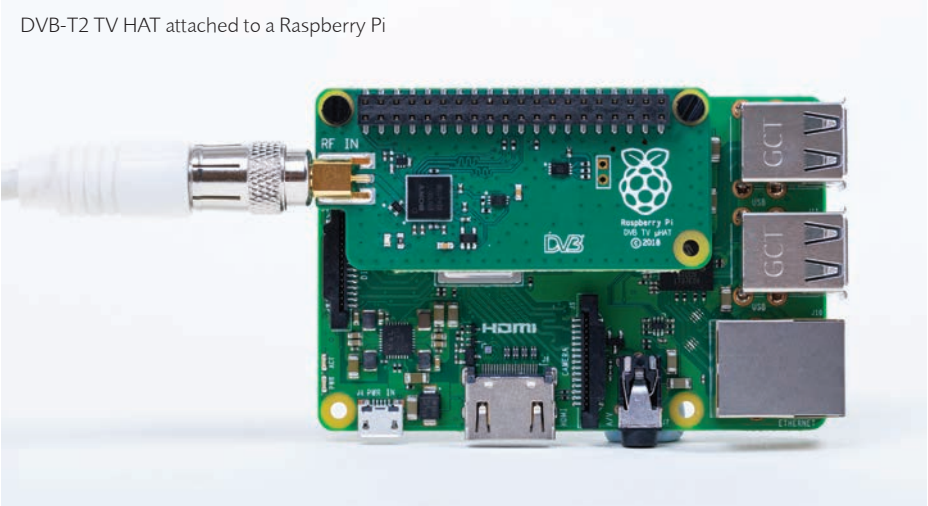
Many customers use Raspberry Pi as a low-cost set-top box, running the Kodi media centre platform, and playing video at resolutions up to 1920x1080, bit rates up to 60 Mbps and frame rates up to 60 fps, stored locally on the device or remotely on a local network. Users wishing to view free over-the-air digital television have generally chosen USB DVB-T/T2 receiver devices, but none of these offer the combination of cost, sensitivity and power consumption required of an official Raspberry Pi product.

At the outset of this project, Sony Semiconductors Solutions Corporation identified the CXD2880 as the optimum solution to satisfy these requirements from Raspberry Pi. Namely a low power, highly integrated multi-system TV receiver.

The CXD2880 integrated circuit is a single silicon die combining an RF tuner and signal demodulator. The die is encapsulated with associated passive components in a compact 6.9 mm x 6.9 mm module. The module components include a crystal oscillator, VHF/UHF band filters and power supply de-coupling capacitors.

The CXD2880 features a low noise figure RF tuner to aid reception in locations with marginal transmitter coverage. This low noise figure also improves indoor reception with portable antennas. The tuner is combined with a DVB-T and second-generation DVB-T2 compliant demodulator based on Sony's technology deployed in several millions of TV sets and set-top boxes. The CXD2880 supports worldwide DVB-T/T2 signals with 5 MHz, 6 MHz, 7 MHz and 8 MHz channel bandwidths.

DVB-T2 TV HAT attached to a Raspberry Pi



ONE CHALLENGE DURING HARDWARE DEVELOPMENT WAS MAINTAINING RF SENSITIVITY WHILE STREAMING OVER SPI.

Additionally, 1.7 MHz is available for DVB-T2. The typical power consumption for DVB-T signal demodulation is as low as 200 mW.

A key feature of the CXD2880 is the serial peripheral interface (SPI). Connecting only four signals to the Raspberry Pi's processor, tuning control and streaming of MPEG transport stream data is achieved. MPEG transport data streaming exceeding 40 Mb/s is possible; however, if required, internal hardware PID filters may be employed to reduce the stream data rate.

HARDWARE CHALLENGES

Raspberry Pi worked closely with Sony to develop, validate and manufacture the Raspberry Pi TV HAT accessory. This conforms to a revised version of the HAT (Hardware Attached on Top) mechanical specification, allowing it to interface cleanly with the low-cost Raspberry Pi Zero W, as well as its big brother, the Raspberry Pi 3B+.

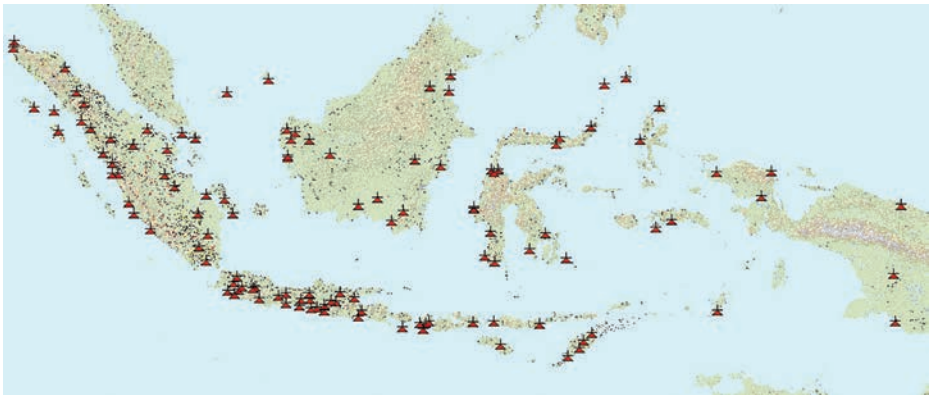
One challenge during hardware development was maintaining RF sensitivity while streaming over the SPI. Due to the small form factor of the TV HAT, careful design of the PCB (printed circuit board) layout and component selection was required.

On the software side, it was necessary to port the existing software driver code to the Linux open source kernel. Although the Linux DVB API used in the kernel is mature, several modifications of the driver were required to adapt to the coding syntax and format of the Linux media framework. Streaming of MPEG transport stream data over the SPI bus was a new feature introduced to the Linux kernel, requiring performance validation.

The Raspberry Pi TV HAT was launched in October 2018 and has been well received by the Kodi community and the broader Raspberry Pi market. Through using the CXD2880 on the TV HAT, we anticipate an increased awareness and appreciation of RF receiver technology, signal demodulation methodologies and digital audio/video compression.

Tom Berry is an application engineer in Sony Semiconductor Corporation.

Eben Upton founded the Raspberry Pi Foundation, and serves as CEO of its commercial subsidiary, Raspberry Pi (Trading) Ltd.



TVRI has deployed DVB-T2 transmitters at 97 locations.

The transition to new digital viewing experiences in Indonesia

Free-to-air (FTA) terrestrial television has been the dominant platform in Indonesia since its launch in 1962. More than 80% of the population is covered, with a wide range of programming available. In total there are 15 national private FTA broadcasters, over a hundred local broadcasters and one public broadcaster, TVRI, operating throughout the country.

Pay-TV operators on satellite, cable and IPTV have a combined market share of less than 5%; almost all of the content on these platforms is also available FTA. The niche for pay-TV operators is in providing premium content for users with screens of 65" and bigger. Nielsen's 2017 survey showed that television remains the most popular medium, reaching 95% of consumers, compared to 45% for internet, 30% for radio and 10% for cinema.

The high penetration of internet-connected smartphones has not prompted any significant change in television viewing behaviour. Most of the population still enjoy linear television alongside their internet use, with a negligible change in viewing figures. As a result, spending on television advertising has continued to grow, increasing by 5% from 2017 to 2018. The Nielsen survey also revealed that a high proportion of younger viewers like to stream content on their smartphones while watching traditional television.

DTT MIGRATION

Indonesia's migration to digital terrestrial television (DTT) began in 2013, when TVRI and five private broadcasters, each in a different region, were appointed as multiplex operators. They were expected to cover 70% of the population. However, legal complications served to delay the transition process and the new broadcasting law is only due to be approved in 2019.

Despite these legal delays, the Ministry of Communication and Information Technology has endeavoured to continue the migration activity, with TVRI being chosen as the sole public broadcaster to implement DTT across the country. As of today, TVRI has deployed infrastructure at 97 locations (see illustration). Fifteen existing analogue broadcasters have joined as content providers.

The process of establishing TVRI as the multiplex operator continues today. Analogue switch-off (ASO) is expected to be completed by the end of 2020, as is the case in most countries in Southeast Asia. The exceptions are Singapore, where ASO was completed in January 2019, and Malaysia, which aims to complete the process in March 2019.

TECHNOLOGY CHOICES

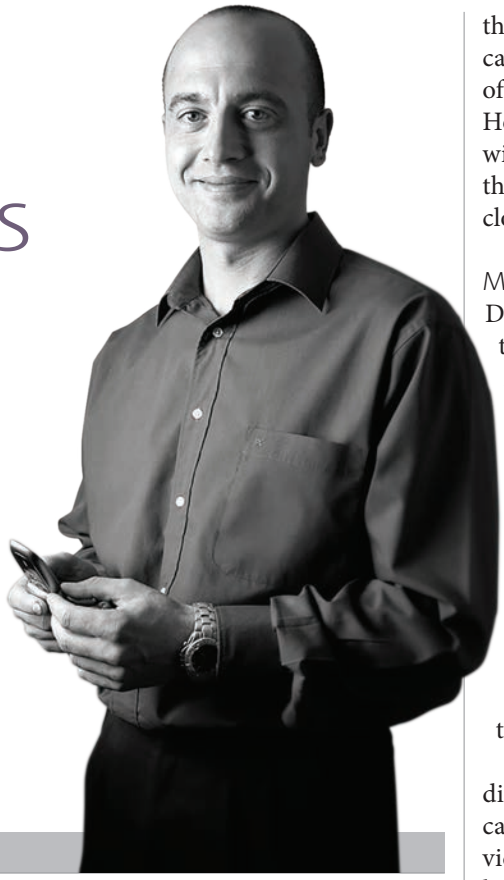
The DVB-T2 system, in combination with MPEG-4 video coding, was selected as far back as 2007. New technology such as HEVC coding, UHD, 8K, VR and 5G broadcast are still being studied to determine an appropriate adoption schedule to benefit all stakeholders.

Despite increased consumer spending on UHD-capable TV sets, available in most big cities, UHD services were not launched by satellite and cable pay-TV operators until 2017. There was a low expected return on investment. The transition to new services such as OTT and multiplatform offers has forced broadcasters to have their legacy technology coexist with newer media technology in the next generation infrastructure. Initial OTT services from national broadcasters are generating huge interest, with most of the content freely available. However, the value of the return on investment remains unclear.

ANALOGUE SWITCH-OFF (ASO) IS EXPECTED TO BE COMPLETED BY THE END OF 2020, AS IS THE CASE IN MOST COUNTRIES IN SOUTHEAST ASIA.

Lily Rustandi has been a Technical Broadcast Advisor at Indonesia's Ministry of Communication and Information Technology since 2005. She is involved in consultations related to technical, regulatory and promotional aspects of DTT.

Towards unlimited OTT services using broadcast links



CHRISTOPHE TROLET

OPINION

Over-The-Top (OTT) for television and video is among most disruptive technologies in our industry. With OTT we can truly deliver on the "watch TV anywhere, anytime, on any device" promise: linear and non-linear television content on tablets, smartphones or PCs, in addition to the fixed TV set. Video consumption possibilities have exploded thanks to 4G networks with unlimited data consumption, the widespread availability of Wi-Fi in public areas and the growth of optical fibre offerings. According to a recent report from Parks Associates, more than 310 million connected households will have at least one OTT service by 2024.

In contrast with IPTV, which operates on managed networks, OTT services are delivered over the open internet, allowing OTT service providers to monetize their content directly by themselves. OTT technology relies on HTTP to deliver each video stream to the user: a dedicated connection per user is implemented to deliver the same live television content.

OTT SHORTCOMINGS

However, OTT services are heavily impacted by network conditions and the number of simultaneous sessions requesting the same video content. To cope with bandwidth fluctuation, ABR (Adaptive Bit Rate) enables the dynamic adaption of content bit rates, reducing or increasing video quality. To handle this, devices use buffering mechanisms, which leads to very high latency and degrades the Quality of Experience (QoE). We're becoming familiar with the phenomenon of neighbours cheering a goal while you watch the same content with a 30 second delay.

Some solutions are emerging to cope with the shortcomings of OTT technology: CMAF would reduce delay issues by using smaller chunks. Huge numbers of simultaneous connections can be addressed by improving CDN coverage, with local caches at the edge of the network infrastructure. But at what price? And what if, as happened recently in the island nation of Tonga, you lose internet connectivity for a couple of weeks?

Without any doubt, delivering video content over satellite and digital terrestrial networks is the most reliable way to offer the best QoE regardless of the number of viewers. One satellite carrier can instantly serve millions of people with television channels. However, broadcast networks use a wireless delivery mechanism based on the MPEG-2 Transport Stream, which closes the door to most non-TV devices.

MULTICAST ABR

DVB's TM-IPI group is working on the standardization of a point-to-multipoint delivery mechanism for OTT content, to allow tablets, smartphones or PCs access the services as they would over the open internet but using broadcast or multicast capable networks. Multicast ABR (mABR) technology relies, at the reception point, on a multicast to unicast proxy that turns the multicast streaming into unicast sessions, allowing for HTTP requests as per typical OTT acquisition.

Using mABR over their satellite or digital terrestrial networks, broadcasters can instantly feed with television and video, and without additional costs, hotspot Wi-Fi for local distribution to households, to public areas (malls, parks, bus stations) or even to moving vehicles, with highly robust mobile-capable digital terrestrial networks. Satellite broadcasting with mABR is the perfect solution to avoid clogging telecoms networks with the simultaneous delivery of video content to thousands of remote 4G/5G stations and DSLAMs: the content is available everywhere without flooding the core network.

The delivery of OTT content over broadcast links is an extraordinary opportunity for broadcast operators to leverage their service offering, providing multiscreen services in addition to their regular broadcast services. It ushers in a new era of unlimited access to their television content everywhere, enabling additional revenue through addressable advertising or subscription-based advanced on-demand services. And more, once the delivery of linear and non-linear television content over broadcast or broadband networks relies on the same payloads, i.e. as the OTT payload, broadcasters would even save additional CAPEX and OPEX by mutualizing their playout centre and optimizing their distribution network.

Christophe Trolet is Satellite Market Director with the French-based DVB Member company ENENSYS Technologies.

How DVB could facilitate a path to greatly increased device reach

PHILIPPE STRANSKY-HEILKRON

OPINION

The TV tube is being replaced by huge flat screens and a plethora of portable devices offering content anywhere, anytime. These consumer devices provide a video screen but ignore the DVB standards – DVB-S/C/T, CSA, SI and PSI – that enabled the foundation of digital free and pay television. These multimedia devices are specified by other groups, mainly 3GPP, or use industry standards defined by large companies, like Microsoft or Apple, for their own ecosystem.

The conversion required before a DVB broadcast signal can be consumed on a portable device is complex and expensive, impacting transport, encryption, codec, interlacing, etc.

Signal conversion can be simplified by modifying the broadcast signal at the source, to make it more compatible with portable devices without impacting existing operations. This approach could enable the introduction of new services reaching billions of DVB-compliant receivers and further billions of portable devices with a very simple conversion.

BROADCAST TO PORTABLES

Broadcasting is the most efficient and cost-effective way to get high quality content to large number of devices, also enabling efficient coverage of low-density areas and those lacking high speed broadband.

Portable devices usually do not support DVB-S/C/T: they connect to 3G, 4G, or Wi-Fi networks. They expect content over HTTP, as few devices natively support other streaming protocols. To transmit broadcast signals to portable devices, a converter is required. For example, a converter from DVB-S to Ethernet or Wi-Fi with IP encapsulation of MPEG-2 TS packets.

CSA TO AES

Broadcast pay-TV content is packetized with MPEG-2 TS and encrypted with the DVB Common Scrambling Algorithm. Portable devices usually do not implement DVB-CSA, but they need to respond to other needs, like securing internet traffic. Therefore most implement AES, a robust, license-free algorithm that can be implemented in hardware or software. Technically, a broadcast network could use AES encryption instead of DVB-CSA. (Note that 128-bit AES is approved by the Hollywood studios.)

For OTT content, the industry is still discussing which of two AES modes, CTR or CBC, should be used for all devices. Convergence is expected in the coming years and DVB should also make a recommendation. It is worth noting that recent set-top boxes already support AES CBC and CTR in hardware. Therefore, nothing really prevents new broadcast pay-TV services from using AES instead of DVB-CSA, and in particular DVB-CSA3, which is still not widely used.

WHAT ABOUT CODING?

When launching new services, broadcast operators should also consider which compression algorithms to use, as portable devices do not natively support older technologies like MPEG-2 compression or interlaced video content. Using technologies that are supported by both set-top boxes and portable devices allows operators to reach both classes of device with the same broadcast stream. It would avoid having to implement complex transcoding in the converter, and the resulting increased latency. Note that this requirement for format compatibility also includes subtitles, containers and encryption.

DVB could provide some recommendations. For example, especially for new services, broadcast operators could consider including additional elementary streams with the broadcast stream, to minimize the conversion required by portable devices.

Existing broadcast services probably cannot be modified to be compatible with portable devices without disrupting existing receivers: the only solution is to use a complex signal converter that implements trans-scrambling and transcoding.

However, new services are introduced often, and broadcast operators are most probably using set-top boxes that provide a high level of technical flexibility.

Improving signal compatibility with portable devices could admittedly result in higher bandwidth requirements. However, this would be offset by the commercial benefits for a broadcast operator of significantly extending the device reach with the use of a simple converter at the receiver.

Philippe Stransky-Heilkron is Chief Architect with NAGRA, the digital television division of the Kudelski Group. He has worked with the Swiss-based company since 1996.

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