DVBSCENE

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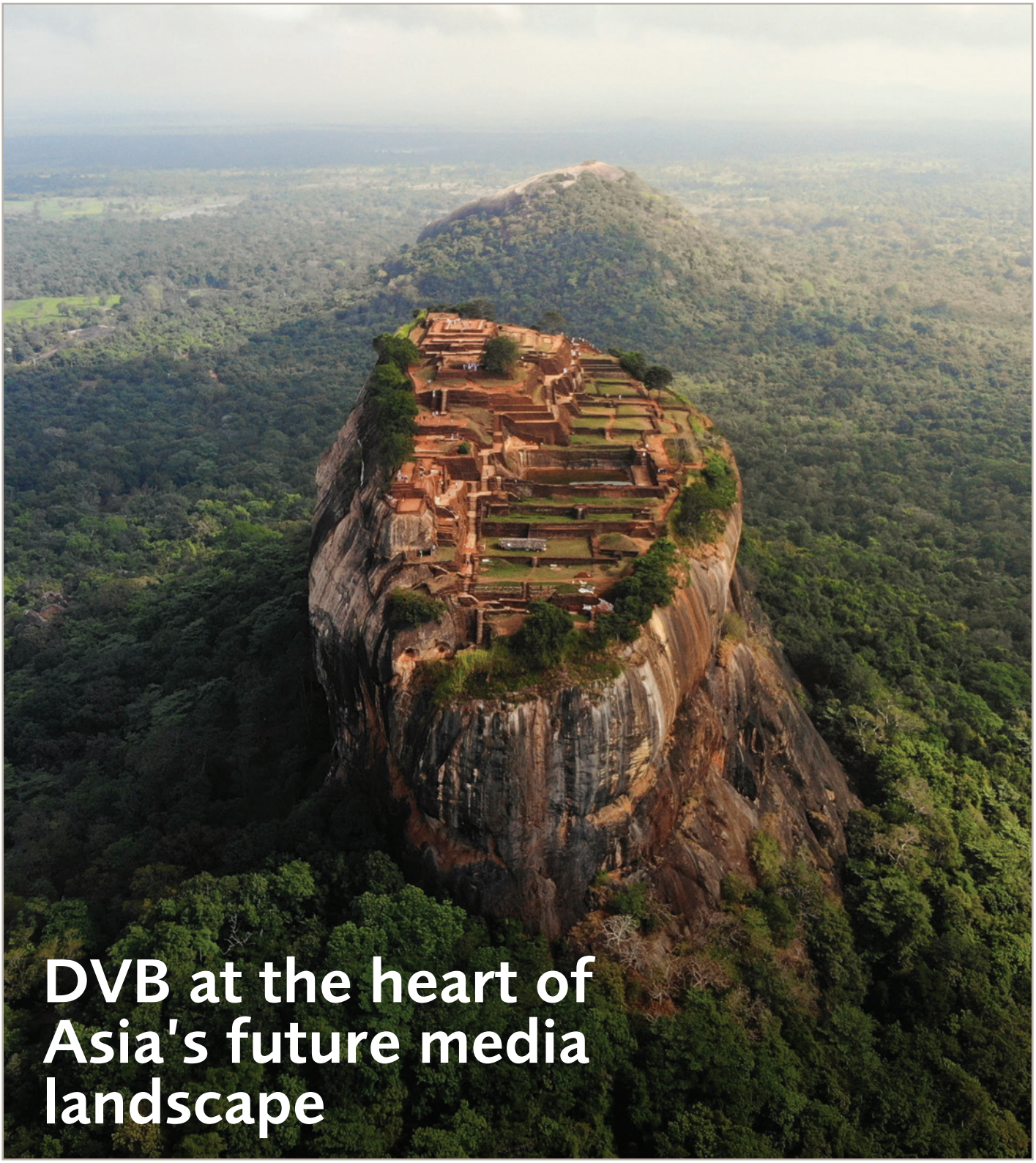

DVB at the heart of Asia's future media landscape

DVBSCENE

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On the cover: Sigiriya is an iconic ancient rock fortress in Sri Lanka. DVB solutions continue to advance across Asia, from the new DVB-S2X service in Sri Lanka (p8) to demonstrating DVB-NIP in India (p6) and spreading the word on DVB-I in China (p3).

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Applauding DVB's hard work

Emily Dubs
Head of Technology, DVB Project

The past few months have been characterized by commitment and hard work throughout the organization on a wide range of topics, including sensitive ones.

September's busy IBC marked a return to physical events, with a high level of engagement from the 20 Members involved in the large-scale DVB demo. We highlighted the unification of media delivery on both the transmission and reception sides thanks to DVB-NIP and DVB-I respectively. This strong message, in particular the strength of DVB-I for service aggregation, was underlined when live OTT services received via DVB-NIP over satellite were seamlessly integrated – on the fly – into the DVB-I service list and made available to all devices on our booth in Amsterdam.

Our IBC2022 activities triggered a great deal of activity, both on standardization and implementation. The pressing need to link those two aspects inspired the creation of our new DVB-I Forum. With more than 200 members already, it allows anyone with an interest to share knowledge and provide feedback on the specifications. This applies not only to people involved in large trials like those in Germany and Italy, but also the various stakeholders considering DVB-I adoption (regulators, manufacturers, service providers, etc.). The Forum's moderator, Gordon Maynard, reports on page 4.

The community around DVB-NIP has been also very busy, thoroughly committed to validating the end-to-end solution thanks to contributions from Members representing the whole value chain, boosted by the simultaneous emergence of strong market traction (p7). Live satellite feeds are now on air for testing and trials in Europe, North Africa, and soon Latin America, where projects are under way and some tenders have already been issued, such as one from the Peruvian government.

Native IP is also ideally matched to the needs of India, where participation in an ABU event in November allowed me to learn directly about its relevance for India's nascent media delivery policy that aims at achieving the UN's Sustainable Development Goals. A central challenge is connecting hundreds of millions of people in rural areas. I was subsequently invited to speak during BES India 2023 – the government-owned event – in February, where we also committed to show the ease of implementation and reliability of DVB-NIP, offering a live demonstration using the existing 6 kW DVB-T2 transmitter in Delhi. Thanks to the dedication, hard work and efficient collaboration of a few Members (p6), the demonstration was prepared within barely two months and successfully showcased at the BES India exhibition, where a very well-attended DVB booth popped up.

Another area where stunning work has been achieved is, indisputably, on new video codecs. The related commercial and technical subgroups worked tirelessly towards the inclusion of AV1 in the DVB specifications (in addition to VVC and AVS3), in parallel with the successful approval of the commercial requirements for dual layer video codecs.

Sadly, I'm running out of space to cover several other recent achievements: the completion of DVB-MABR Phase 2; or the launch of the new work item on DVB-RCS2 for non-geostationary systems, that ensures DVB remains the home for all satellite solutions, including for non-broadcast applications.

NEW & UPDATED SPECIFICATIONS

Here we list DVB documents published since the last issue of DVB Scene. Find the latest published version of every DVB specification in our library: dvb.org/specifications

Adaptive media streaming over IP multicast (DVB-MABR)
March 2023 • DVB BlueBook A176r3 (Interim draft TS 103 769 V1.2.1)

Adaptive media streaming over IP multicast – Implementation guidelines and worked examples (DVB-MABR)
March 2023 • DVB BlueBook A181r1

Frame structure, channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)
February 2023 • TS 102 755 V1.1.1

Specification for Service Information (SI) in DVB systems (DVB-SI)
November 2022 • DVB BlueBook A038r15 (Interim draft EN 300 468 V1.18.1)

Implementation and usage of Service Information (DVB-SI Guidelines)
November 2022 • DVB BlueBook A005r10 (Interim draft TS 101 211 V1.14.1)

Specification for the use of Video and Audio Coding in Broadcast and Broadband Applications (DVB-AVC)
November 2022 • DVB BlueBook A001r21 (Interim draft TS 101 154 V2.8.1)

DVB MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks (DVB-DASH)
October 2022 • DVB BlueBook A168r6 (Interim draft TS 103 285 V1.4.1)

Service discovery and delivery protocols for a DVB Home Broadcast system (DVB-HB)
October 2022 • DVB BlueBook A179r1

Commercial Requirements for signalling of Accessibility Services in DVB
October 2022 • DVB BlueBook C102

Service Discovery and Programme Metadata for DVB-I
September 2022 • DVB BlueBook A177r4 (Interim draft TS 103 770 V1.3.1)

NEW DVB MEMBERS

Find out how to join the DVB Project by visiting: dvb.org/join

FTA Communication Technologies, known for its Inverto branded products, is a leading supplier of outdoor equipment and content delivery solutions for the global satellite TV markets.

"With broadcast networks migrating from legacy transport streams to modern IP-based streaming, we are excited to join the DVB effort and help accelerate the introduction of new standards such as DVB-NIP, so solutions like our cloud-based service for content delivery over broadcast networks, servicing rural communities, delivering multiscreen entertainment at land, sea and air as well as to CDN and 5G edges, are interoperable and future proof", said Gil Laifer, the company's VP of Product. **(inverto.tv)**

A word from the PCM chair

Elfed Howells (Hisilicon/Huawei)

My word for this edition of DVB Scene is *momentum*. The return to a full face-to-face cycle of DVB meetings has been refreshing, not only because we've been able to have a drink with colleagues, but also because of the ideas spawned and the opportunities provided for closer collaboration.

From the seed of an idea at IBC, the DVB-I Forum has grown to become a flourishing community for DVB-I implementers and developers, ably moderated by Gordon Maynard on behalf of the DVB Project Office. Join the Forum via the DVB-I microsite (dvb-i.tv). Speaking of which, the site itself has also become very popular, with ever-increasing traffic due to news of the trials in Germany, Italy and beyond gathering great interest.

We've also been a great deal more active in our outreach, with trips to India and China, as well as around Europe, while also welcoming friends and colleagues from Japan and the US to collaborative meetings and demonstrations.

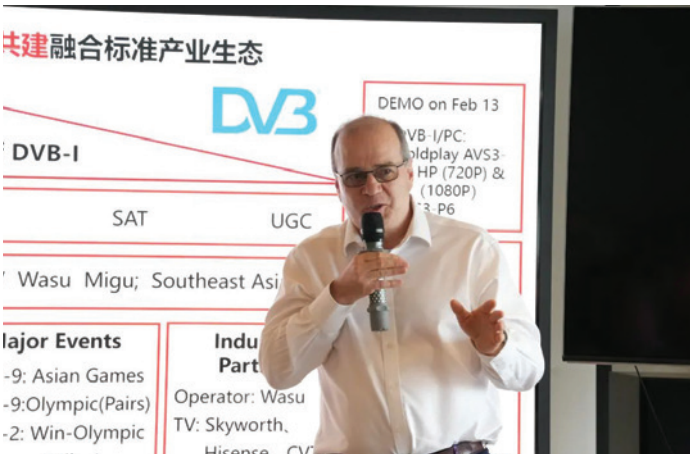
In India we demonstrated live DVB-NIP over Doordarshan's DVB-T2 transmitter in Delhi, a world's first. And in China we gathered 30 companies – among them nine DVB Members – and 50 people in Shenzhen to discuss and experience DVB-I and Next Generation Video Coding, in conjunction with the AVS Industry Alliance at the Chinese National Ultra HD Video Innovation Center (p4).

We have also seen excellent momentum on the Next Generation Video Coding (NGVC) work, with the completion of Phase 1, the initial BlueBook publications, first demonstrations, and example streams becoming available in our V&V repository. NGVC is now firmly on the road to ETSI publication, giving implementers full confidence in the specifications for 8K and super-efficient UHD video delivery for all DVB networks.

There is also momentum on new work items, with new study missions on Energy Aware Delivery and Consumption, Object-Based Media and Volumetric Video (p15). If you have other new ideas for DVB work items, information is now available on the DVB website that will guide you through the process (dvb.org/newwork). Even better, join us at DVB World 2023 (22 June, Brussels) where our unconference will be brimful of innovation and ideation. See you there!

Information and registration for DVB World 2023: dvbworld.org

Promoting DVB-I in China



February's *Ultra HD Standard International Cooperation Seminar*, co-sponsored by the AVS Industry Alliance, the National Ultra HD Video Innovation Center (Shenzhen) and Hisilicon Technologies, provided an opportunity to raise awareness of DVB solutions among key industry stakeholders in China.

In their capacity as chairs, respectively, of the DVB TM-I and CM-SEG groups, Paul Higgs (R) and Ken Lawrence (L) brought presentations and demonstrations that showed how DVB-I can be leveraged to accelerate the roll-out of UHD services.

The event, which took place at the IIVA Lab in Shenzhen, was attended by around 50 people representing 30 Chinese organizations, including nine DVB Members. Further promotional activities in China are under consideration in the DVB Promotion & Communications Module.

Test content for VVC and AVS3

The DVB Project has published test content for the two codecs most recently added to its core specification for the use of video and audio coding. A selection of bitstreams for both VVC and AVS3 can now be downloaded from the Verification & Validation section of the DVB website. The transport streams were created using a variety of uncompressed SDR (Standard Dynamic Range), HDR (High Dynamic Range) and HFR (High Frame Rate) content.

The test content is made freely available to implementers for the verification and validation of VVC and/or AVS3 video service delivery according to DVB specifications, and to test the interoperability and functionality of related equipment.

DVB AVC

More voices and more ideas for DVB-I

Gordon Maynard, moderator for the DVB-I Forum

DVB-I has come a long way since Commercial Requirements were first drafted in 2018. By summer 2022, there were two national proofs of concept up and running, in Germany and Italy, which proved that DVB-I had the potential to enable hybrid services.

At IBC last year, conversations turned to implementation and there was agreement that guidelines would be needed to support the creation of interoperable services and devices. To make the process as inclusive as possible, a new way of working was proposed: an open online forum rather than the usual members-only meetings and email reflectors.

In December, I was asked by DVB to take on the role of moderator for the new DVB-I Forum. I had been working on DVB-I as a consultant and developer and the chance to help support the next phase of its development was irresistible. This is a new way of working for DVB (and for me), so my brief was minimal: keep the conversation going, encourage participation and report on key issues. We have now agreed a process whereby I will take a summary of discussions to TM-I and CM-I for decisions on how issues should be closed, and to take matters that need more work back to the forum.

It's still early days but we've already raised and discussed some important issues related to DVB-I: the structure of Service Lists, how to implement DRM, using DVB-I to set up DSat receivers, regulator flags, and new ideas for linked applications, to name a few. The forum has reached 200 members and we've had some great contributions from both well-known members of the DVB community and new participants.

I'd encourage anyone interested in DVB-I to join and join in – it's a great opportunity to learn about and influence the ongoing work to make media delivery fully hybrid.

You can access the forum via the DVB-I website (dvb-i.tv); post an introduction, then start contributing!

Seeking consensus on convergence

Peter MacAvock (EBU), Chair of the DVB Project

The media industry is undergoing its biggest revolution since the invention of television. We thought migrating from analogue to digital TV was hard – it was much easier that what's going on now.

As we have seen in the cable TV sector, the march of IP is all conquering. What was once a transport stream delivered using 64-QAM and DVB-C is now largely based on DOCSIS with the latest versions being IP-only. (As an aside, this has an interesting impact on the delivery over cable of analogue FM radio services, which is still relatively popular. This is not possible anymore: it's all IP, even down to lower VHF frequencies.)

Telephony is IP, cable TV is fast becoming IP. Direct broadcast satellite and digital terrestrial television (DTT) remain transport stream strongholds. But the world around broadcast television has migrated to IP, with households in developed markets now subscribing to multiple SVOD offerings and questioning the relevance of the public service licence fees that underpin European culture.

DVB'S BIG SHIFT

DVB too has changed significantly from when I took over as chair in 2017. It has pushed an IP-first policy that is bearing fruit. DVB-I is a popular talking point at trade shows and can now be found in TV sets, underpinning extensive trials in Germany and Italy. Will it move to a mainstream technology available in all TV sets? Time will tell, but if I were a DTT operator, I would be building DVB-I into my proposition now.

As reported elsewhere in this magazine (page 6), DVB's recent successful demonstration at the BES India event is significant in showing how the organization has adapted to the challenge of a full-IP stack delivered over a broadcast network. Native IP (DVB-NIP) offers a full-IP architecture over a broadcast bearer, much like ATSC 3.0. Where it becomes powerful is when combined with other IP-based means of reaching consumers.

But this IP focus means DVB is now referencing more and more technologies coming from organizations such as IETF and W3C. On the surface, this would appear to be no problem – indeed it is both logical and desirable.

However, DVB's processes are built along the same lines as those of organizations like MPEG, ETSI and others with IPR policies based on FRAND (fair, reasonable and non-discriminatory) terms applied to standard essential patents (SEPs). This contrasts with some of the organizations specifying internet technologies, where royalty-free patent policies are popular. When the two worlds meet, sparks fly, stressing DVB's consensus-based approach almost to breaking point. But addressing these stresses is key to serving the industry by providing for the interoperability and reliability of new technologies.

SCOPE FOR COLLABORATION?

In considering the confluence of the worlds of internet and broadcasting, we come once again also to the need for greater collaboration and cooperation between DVB, ATSC (US), ISDB (Japan) and DMB (China), and the variants. Internet technologies are global, and telecommunications is now also global; it's time for those organizations supporting digital broadcasting to also come together.

Of course, you might expect me to say that DVB differs from those other organizations mentioned, but I think it does in at least one important way: our focus is on providing for DVB services across *any* network – traditional DVB broadcast or IP networks. Some other organizations are squarely focused on providing solutions for the broadcast industry; a subtle but important difference. But peel away the names, the geography and, to an extent, the politics, and you'll find technologies common across all these systems. Collaboration should focus on these similarities, not on the differences.

"Will it move to a mainstream technology available in all TV sets? Time will tell, but if I were a DTT operator, I would be building DVB-I into my proposition now."

Peter MacAvock is Chair of the DVB Project, a position to which he was re-elected in July 2022. He is also Head of Distribution Platforms and Services at the European Broadcasting Union.

Public broadcaster Doordarshan kindly made an existing DVB-T2 transmitter available to us. The staff at the Pitampura transmission site provided great support to get the demo up and running. Here we see Anita Gart, Vijay Kher and Lalit Mohan Joshi, who provided invaluable support.

We installed a mini DVB-NIP headend integrating elements from Quadrille and EasyBroadcast for OTT packaging, conversion to multicast and CMS. A TSoIP adaptation to ASI from ST Engineering made it possible to reuse the DVB-T2 modulator already in place.

The world's first terrestrial DVB-NIP transmission

The BES India 2023 exhibition in Delhi in February provided an opportunity for a live demonstration of DVB Native IP broadcasting, the first ever to use a terrestrial network.

As the transmission tower is ~15 km from the exhibition centre and the modulation parameters were not set with indoor reception in mind, it was necessary to install a receiving antenna on the roof and run a 50–60 m line to the booth.

The set-up on the DVB booth was simple and straightforward. The terrestrial antenna was connected to a DVB-NIP gateway from EKT, which streamed directly to a range of tablets and smartphones over Wi-Fi. (Swiss chocolates and DVB pins also attracted visitors!)

The support of our demo partners was greatly appreciated. Present in New Delhi were Mohsen Haddad, Co-founder of EasyBroadcast (left) and Xavier Battas, CEO of Quadrille Ingénierie, pictured here with DVB Head of Technology Emily Dubs.

Emily Dubs spoke at the BES India conference, with a presentation that explained how DVB Native IP is ideally suited to fulfilling the needs of the country's transition to a converged broadcast/broadband future.

A steady stream of visitors passed by the booth, eager to see this world-first demonstration. Here we see Shri K. Rajaraman, Telecoms Secretary in the Indian Ministry of Communications (right), alongside Sunil, Additional Director General of Prasar Bharati.

The success of the demonstration – with many visitors genuinely surprised that we could deliver OTT services from the DVB-T2 transmitter in Delhi – owed a great deal to the work of Aymeric Pezot, a media technology consultant based in India. It was largely his efforts that made it possible to interface, in a very short time frame, the first all-in-one mini DVB-NIP headend to an existing DVB-T2 transmitter.

Remote education and aeronautical entertainment are just two of the many use cases that solutions based on DVB-NIP are targeting

When a standard becomes *the* standard

Alex Beach (ST Engineering iDirect)

The DVB-NIP (Native IP Broadcasting) standard bridges the gap between broadband and broadcast networks and paves the way for a truly converged media distribution solution.

Even before the standard had been finalized, industry stakeholders who understood its huge potential started building working solutions that are now ready for implementation. SKYflow is one such solution, an ecosystem created by a group of active DVB Members that includes Broadpeak, EasyBroadcast, EKT, Quadrille Ingénierie and ST Engineering iDirect. Their ecosystem has been demonstrated at major tradeshows around the world and is now finding its way into real-life use cases.

DVB-NIP uses the efficiency of broadcast networks for large-scale content distribution to IP devices, fully integrating broadcast technologies with those used in broadband networks. Therefore, it is no surprise to see large projects referring to the DVB-NIP standard to ensure long-term support and compatibility with the future of broadcast.

For example, in a recent government-driven tender in Latin America, the project specifically requested compliance to the DVB-NIP standard and membership of the DVB organization to ensure that its future partners will deliver a working product that can interact with current and future players.

Along with our partners, we believe that the usage of the standard, augmented by additional features, offers even broader applications than those foreseen by the first round of RFPs to include DVB-NIP. Below are some of the market applications that can benefit massively from the new standard.

Remote education: live content, VOD assets and materials like e-books, papers and exams can be distributed safely to any school and any home in a country using cost-effective satellite infrastructure. Bi-directional connectivity is possible through VSAT systems, where a return path can be created in an instant.

Remote hotspot / download to go: in regions where internet access is not readily available, a data hotspot can deliver content for all to watch on the mobile/tablet/set-top box when they want it. Smart algorithms can ensure the remote content is managed to always deliver the most needed shows and data. It's a great new way to deliver an internet-like experience while being offline.

Network offload: mobile network operators will be able to complement their 5G services with satellite connectivity to offload terrestrial networks at a large scale. They will be able to take advantage of satellite's inherent multicasting/broadcast functionality for all new use cases, such as connected cars, while preserving high-value wireless spectrum for latency-sensitive services. Or, they can use satellite's longer range to complement the buildout of 5G in remote areas where developing terrestrial networks for enhanced broadband services is simply too cost prohibitive.

Aeronautical: this market faces a constant struggle to reliably connect passengers and crew with streaming services due to the complexities involved with being at 35,000 feet. A platform like SKYflow can provide a near ideal solution to the most challenging global coverage and range issues.

Maritime: commercial and recreational shipping will be able to access marine information, however remote the location, all day, every day. This can have a positive impact on crew morale and their professional skills.

FUTURE OF BROADCAST

All these use cases illustrate how DVB-NIP can reach billions of connected devices in people's hands, meaning that network boundaries will be pushed further than ever before to enable new types of applications and services across almost every industry. This market growth is only set to increase – and, of course, traditional barriers to content options no longer apply.

This is the future of broadcast.

Alex Beach is Head of Media & Broadcast Market Development at ST Engineering iDirect. He is tasked to manage and grow market position and revenues in the Media & Broadcast vertical, including DTH, distribution, contribution, satellite OTT, and IP content distribution over satellite.

Bringing Sri Lanka into the digital age with DVB-S2X

Pranalanka Warunawansa (Freesat)

June 2022 saw the launch of Freesat Sri Lanka, a subscription-free DTH (direct-to-home satellite) platform serving the island nation in the Indian Ocean. It was the first such service in Asia, and only the second worldwide, to use DVB-S2X.

For around 20 years, Sri Lanka had been struggling to implement digital television, without any success. Many attempts were made, with the latest being to deploy an ISDB-T service utilizing a transmission tower in Colombo, but with no solid plans to provide nationwide coverage in a country of 65,610 square kilometres with heavily varied terrain.

Sri Lanka was thus still relying on old analogue terrestrial transmission for basic television viewing, and the difficulties of providing coverage due to the topography of the country were very apparent.

Sri Lanka has 4.5 million television viewing households, out of which nearly two million subscribe to pay-TV services. The remainder had to make do with poor analogue television reception, served by around 20 local stations. The prominence and importance of local television stations for audiences in Sri Lanka meant that they were viewed even with the inferior picture quality associated with analogue technology.

Our team identified this gap and the opportunity in the local broadcasting industry and proposed Freesat, a national digital television platform that would reach every household in every location in the country – and for free. Initial proposals to the Ministry of Media and Telecommunications Regulatory Commission were made in mid-2019 and after almost three years on a greatly challenging journey, we finally managed to bring this project to reality in June 2022.

We obtained all required licences and approvals, enabling us to set up a state-of-the-art broadcasting facility on the west coast of Sri Lanka. Freesat is now in operation and serving the entire country with all local television channels on board with a mix of carefully selected foreign content as well, yet zero cost to viewers.

Our unique selling proposition is nationwide high definition digital television for everyone for free.

WHY DVB-S2X?

Right from the outset, we were very clear about our technology strategy and wanted to opt for the latest digital television technology. We wanted to stand at the forefront of digital broadcasting as well as to obtain best-in-class efficiency within our network. While almost all current DTH platforms operate on DVB-S2, we decided to go for DVB-S2X for its unparalleled efficiency.

By combining DVB-S2X as our transmission technology and HEVC as our video coding technology, we have managed to achieve the optimal combination of throughput and transponder efficiency for the whole platform. This, in return, is passed on to our clients, who are broadcasters on this platform; it enables us to offer them affordable channel carriage, the cost of which was prohibitive in the early days due to inefficient technologies.

Freesat runs a state-of-the-art broadcasting facility on the west coast of Sri Lanka

Although S2X had been used in professional environments, it still had not been used in the domestic receiver industry. Hence, the biggest challenge we faced was to get a compatible chipset solution at the right price point for our set-top box (STB). We had discussions with almost all the major chipset manufacturers and finally managed to agree on an ideal solution using cutting-edge technology from Montage LZ Technologies. With its latest chipset family, Montage was able to provide all that we required to achieve our targets. We built our STB solution on top of their SoC (system on a chip) at almost the same price point as existing DVB-S2 receivers.

BENEFITS

The most significant benefit of our technology stack is its efficiency in terms of bits per MHz. While DVB-S2X offers various modulation and coding combinations, we carefully worked out the best link budget in order to maximize the throughput while maintaining the maximum link availability as well.

We are happy to say that we have achieved almost 20% extra throughput by choosing DVB-S2X. Relying on DVB-S2X transmission and HEVC compression, we are at the forefront of the region's digital

Pranalanka Warunawansa is Chief Technology Officer for Freesat Sri Lanka, where he heads up the engineering and in-house R&D team. With over 20 years of industry experience, he has spearheaded the rollout of Freesat.

broadcasting not only in offering HD but even as a 4K-ready network.

As we started to work on this project, we set some baseline aims that would set us apart from other projects. First and foremost was to be vendor agnostic. Hence the whole project was designed in-house using a mix of components from several vendors and without depending on a turnkey solution from a single vendor. By doing so, we have managed to implement a highly scalable yet vendor-agnostic all-IP digital television headend. We went the extra mile by having our own R&D team develop certain elements to maximize independence and to reduce certain ongoing cost components. Here, the cost of subscriber equipment was a key component, owing to our subscription-free model.

A second key aim was that the whole implementation, from its design to going live, was done by a local engineering team. We didn't involve any third-party integrators or consultants.

The third is that we implemented a conditional access system that is fully compliant with DVB Simulcrypt. This was 100% developed by our own R&D team. I believe we can be justifiably proud of this. The implementation was done with the most advanced security technologies available, integrating the entitlement management within the STB chipset itself. And the product has come up to a stage where we are now planning to spin off a separate entity to promote this as a stand-alone product in the market.

AND THE FUTURE?

In terms of the broadcast network, we are already at the edge and don't anticipate requiring any enhancements or upgrades for at least the coming decade.

However, we are planning to enhance our current DVB-S2X STB solution in two main areas. Firstly, to enable edge-IP delivery for in-building coverage using existing IP infrastructure where RF cabling is prohibitive. Without any cost burden, we can extend the same STB offering over IP and receive the DVB transport stream over IP.

Secondly, we are working on a unique audience measurement system to be integrated in the STB solution to capture viewing data that will be available to other stakeholders of the local television broadcasting industry for better decision making.

We are also happy to announce that we have made 10 channels available to the government for a national distance-education platform. This was only possible thanks to the platform efficiency that comes with DVB-S2X.

On a personal level, I am grateful to the management team at Freesat, whose unswerving trust enabled our R&D team to deliver this project successfully. Thanks are also due to SES, our satellite partner. They have worked with us very closely for the last three years, contributing immensely to the success of this project by offering us best-in-class transponder services over their new SES-12 satellite.

Credit is also due to Montage LZ Technologies, whose work on the DVB-S2X chipset helped make the whole deployment a reality, and to our STB OEM partners.

Sri Lanka's complex topography means satellite is an ideal solution for achieving universal coverage

UHD over DVB-T2 takes a step forward in Spain

Pere Vila & Adolfo Muñoz (RTVE)

In December 2022, Radio Televisión Española (RTVE) broadcast most of the matches of the FIFA World Cup in Qatar in live UHD-HDR on digital terrestrial television (DTT). These broadcasts were entirely based on DVB standards, with DVB-T2 used for the DTT broadcasting.

The transmission was carried out from 62 sites covering major Spanish cities and reaching around 60% of Spanish population. Three telecom companies participated in transmitting the signal: Cellnex, which manages the majority of towers throughout Spain, Axión in the south, in Andalusia, and Telecom Castilla La Mancha, which operates in the Toledo area.

The UHD signal was compressed at 60 Mbps and sent from Qatar over IP (SMPTE 2022-2) with redundant circuits (1+1). The 60 Mbps transport stream included the video signal encoded in HEVC (using Main 422-10 @ Level 5.2), 16 audio channels (with 8 PIDs) encoded in PCM and with different multichannel, stereo and mono configurations.

BUILDING THE SERVICE

Upon arrival at the Mediapro production centre in Barcelona, this signal was received in a pair of Sivac-One decoders from Sapec, which delivered the UHD video signal in 4x3G. This signal was then processed to insert the RTVE logo, add graphics, etc., and integrate it with the other signals that made up the broadcast of the channel in UHD.

In the production centre, commentary was added and the audio was encoded in Dolby Atmos using the E-AC-3 codec. During the matches, the ambient sound arrived in 10 discrete PCM channels that were encoded directly using Dolby Digital Plus to deliver Dolby Atmos. Otherwise the signal arrived in 2.0 audio and an automatic up-mixing system (UPMAX ISC from Linear Acoustic) was tested, but in this case not used permanently. Using this procedure, codec changes were avoided during transmission and the user experience was improved, maintaining a constant Dolby Atmos signal 24x7. This signal was embedded in the 3G-SDI signal in the first quadrant.

At the output of the playout, this UHD-HDR (4x3G) video signal, with the Dolby Atmos audio embedded, was delivered to the Sapec Sivac-ONE encoder that compressed the signal according to the following parameters:

- Video coding: HEVC Main10 @ Level 5.1
- Passthrough of the Dolby Atmos audio
- Generation of DVB-SI tables (Service Name, NIT, ...)

This resulted in a final transport stream with a total bitrate of 20 Mbps. This was sent to Cellnex and Axión via IP according to SMPTE 2022-2 and to Telecom CLM via public IP using SRT.

TRANSMISSIONS

Each of the operators was responsible for generating a multiplex with two UHD services. The first, with a bitrate of 20 Mbps, carrying this RTVE World Cup signal and the second, with a bitrate of 12 Mbps, with UHD test content. The latter has, for some time, been used for test transmissions of UHD over DVB-T2, carried out by a group of companies in the audiovisual sector under the auspices of the UHD Spain association, chaired by RTVE.

The modulation parameters selected for these transmissions were: DVB-T2, 32 K Ext. 256QAM 2/3 GI 1/8 PP2 SISO. Tests had previously been carried out to obtain protection against self-interference and a reception field similar to or better than those available in the current DVB-T network. With these parameters, multiple capacities of 33.4 Mbps were achieved.

In conclusion, the transmission of football matches of the FIFA World Cup 2022 by RTVE over DTT in Spain used advanced technologies for coding and transmission of signals. This enabled the provision of a very high-quality viewing experience for Spanish viewers, who could tune in from their homes to an excellent free-to-air UHD signal, with HDR and the BT.2020 colour space, accompanied by Next Generation Audio.


Pere Vila is Director of Technological Strategy for Radio Televisión Española.
Adolfo Muñoz is Director of the Broadcast Area for Radio Televisión Española.

Audio advances showcased during the FIFA World Cup 2022

Last year's FIFA World Cup in Qatar provided an ideal opportunity for broadcasters to showcase the capabilities of the newest audio coding solutions in the DVB toolbox, MPEG-H Audio and Dolby AC-4.

MPEG-H AUDIO IN BRAZIL

Adrian Murtaza (Fraunhofer IIS)

Taking a major step towards the modernization of the broadcast system in Brazil, Globo enabled MPEG-H Audio on their free-to-air broadcast channels in three Brazilian states for the first time. All matches were transmitted in Rio de Janeiro, Recife and São Paulo using an enhanced immersive audio experience according to the Brazilian TV 2.5 standard, a backwards-compatible extension of the existing DTT system.

At the same time, the Sistema Brasileiro de Televisão Digital (SBTVD) Forum is defining Brazil's next-generation broadcast standard (TV 3.0). In another first, the World Cup also saw Globo, Fraunhofer IIS and partners using the already selected TV 3.0 technologies in a complete end-to-end live production to provide 4K HDR video (using VVC) with immersive and personalized sound via MPEG-H Audio.

An MPEG-H Audio monitoring and authoring system from Linear Acoustic allowed Globo to provide a personalized sound experience containing a 5.1+4H immersive mix, alternative commentary options, enhanced ball-kick and fan sounds from the football stadiums, among other audio objects for the user to interact with. MediaTek provided the first chipset with VVC, MPEG-H Audio and DASH support according to the TV 3.0 draft specifications, while viewers were able to personalize the sound experience using an LG TV set with an integrated MPEG-H Audio user interface. Additionally, exploiting the capabilities of the MPEG-H Audio system to enable personalization on the receiving device without decoding the audio stream, the final immersive experience was reproduced over a Sennheiser soundbar with native MPEG-H Audio support.

DOLBY AC-4 IN POLAND

Marcin Mazurkiewicz (Dolby)

Poland's public broadcaster TVP notched up another innovative first, with its use of next-generation audio codec Dolby AC-4 to deliver immersive and personalized TV experiences. Dolby AC-4, standardized in the Polish specification for UHDTV, includes the ability to carry channel- and object-based audio to deliver different experiences.

TVP gave its viewers the possibility to choose between Polish and English commentary, Audio Description, and listening to the match with exciting audio coming solely from the stadium. These personalization features made use of the *audio preselection descriptor*, which is a part of the DVB-SI standard and has been integrated into the audio preselection UIs by TV manufacturers in the European market.

Using Dolby AC-4, TVP could transmit personalized immersive audio to be received by viewers with existing DVB-T2 televisions. The tournament was broadcast nationwide over DVB-T2, which made it available to almost every household in Poland. TVP worked closely with Dolby's Polish and German teams, who provided engineering support before and during the event.

TVP has a track record for audio innovation. In June 2018, the broadcaster introduced its first UHD channel and carried out the world's first free-to-air live transmission of Dolby Atmos immersive audio by a public broadcaster. The broadcaster's pioneering endeavours could pave the way for personalized audio becoming a key differentiator for live sports and for UHD services like these.

Adrian Murtaza is Senior Standardization Manager with Fraunhofer IIS. He has been involved with DVB activities since 2014, focused on NGA standardization efforts. **Marcin Mazurkiewicz** is a Senior Solutions Engineer at Dolby Germany. He is implementing NGA standards with Dolby's partners in Europe, including with TVP for the World Cup.

Using DVB-TTML to unify subtitle generation for broadcast and broadband

Sébastien Bogaert (TV5MONDE)

Available in 198 countries and in 421 million households, TV5MONDE is one of the world's largest television networks. The mission of this francophone service is to promote French speaking worldwide. It does this through eight general entertainment channels, two thematic channels – kids and lifestyle – and the on-demand platform TV5MONDEplus.

For learners, subtitles are a crucial tool. They are provided in 13 languages. Providing subtitles on broadcast services – satellite, cable or terrestrial – for TV sets and set-top boxes, is straightforward, being either teletext-based (DVB-TXT) or using bitmaps (DVB-SUB). For video-on-demand services, subtitles are provided using either WebVTT (web video text tracks) or TTML (timed text markup language) flat files.

SEEKING A SOLUTION

For linear OTT, however, we struggled to identify solutions that could produce packaged WebVTT and TTML streams, in 13 languages, all synced with the linear broadcast playout. We initially tested an approach that would use optical character recognition (OCR) on DVB-SUB bitmap files, but had only limited success with some non-latin alphabets.

The appearance of DVB-TTML, in mid-2018, seemed to offer hope as a relevant format but there was no solution on the market. Some vendors were implementing DVB-TTML at inputs, but none was able to generate it as a source stream.

When we started the process of renewing our live streaming platforms – OTT packaging and origination – in 2020, we pushed the market by introducing DVB-TTML as a requirement in the specifications of our public tender. The winning submission came from Harmonic with its VOS®360 video SaaS platform. Harmonic worked with BroadStream Solutions to adapt their subtitling solution for the provision of DVB-TTML.

Since April 2021, TV5MONDE has been using DVB-TTML as a pivot format between playout and packaging.

Our multiplexers expected specific data chains to fit the PMT (programme map table) descriptors, but video service manager tools were not ready 'out of the box' for describing DVB-TTML.

We worked it out by using sample streams available from DVB.org website, successfully determining the expected values for the descriptor_tag, descriptor_tag_extension and subtitle_purpose. Then we translated them into relevant raw data for our multiplexing equipment to fill in the DVB-SI tables.

Naturally we relied on the DVB-TTML standard itself (ETSI EN 303 560), but also some tables in DVB-SI (Specification for Service Information in DVB systems, EN 300 468).

CHALLENGES REMAIN

We continue to face some challenges, such as identifying up-to-date TR 101 209 (DVB Measurement) probing tools, offering proper DVB-TTML table decoding and analysis. With regard to monitoring, aside from our own web players and the OTT subtitle fragments produced (TTML, WebVTT), we are working on the development of a viewer in collaboration with EDRIS, a French software provider.

As a next step, we are currently studying implementing SMPTE ST 2110-43 in our core playout infrastructure, so that native DVB-TTML is generated upstream.

For the time being, DVB-TTML is distributed out of TV5MONDE only for OTT. However, it could be an attractive option on satellite and cable distribution, as there are real bandwidth savings: a single DVB-TTML track is typically less than 14 kbps compared to 128 or 200 kbps with bitmap subtitles, but this will depend on market readiness (STB vendors).

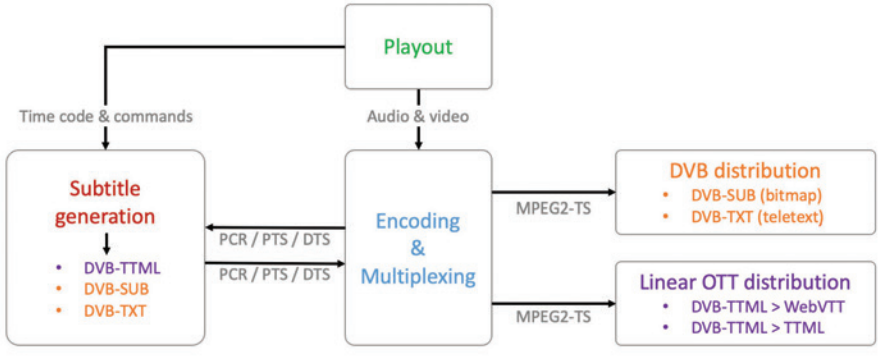


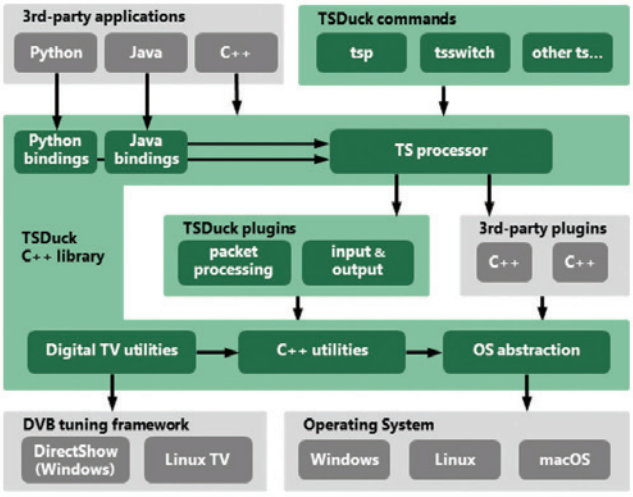
Diagram showing the subtitling workflow at TV5MONDE

Sébastien Bogaert is Head of the Network Operations Centre and of Distribution for TV5MONDE. He led the project to implement DVB-TTML with Harmonic and BroadStream Solutions.

Tool support for AVS3 and VVC video

Thierry Lelégard (TSDuck) & Paul Higgs (DVB TM-I)

Tool support for analysing and processing media used in broadcast and streaming scenarios is seen to be critical in successfully testing and deploying media services, with free availability backed by open-source development of those tools offering a reliable starting point. To support the signalling of DVB's next-generation video codecs, several new features are included in the transport stream. One of the most widely used tool sets for analysing and manipulating transport streams is TSDuck (tsduck.io).



The architecture of TSDuck

TRUSTED TOOL

TSDuck is the Swiss army knife of digital television engineers. It is designed for tests, validation, demos, debugging, integration and other lab activities. Some service providers even use it in production systems.

Like many open-source projects, TSDuck started as a personal need from its author, who had to perform experimental manipulations on live transport streams. From the beginning, a modular approach was used. A "transport stream processor" was developed as a framework, hosting plugins for input, output and packet processing.

TSDuck is a set of flexible command-line utilities that were designed for scripting, to automate transport stream processing. As an example, the in-depth monitoring of a national broadcast network was once performed by a shell script running on a Linux desktop, equipped with a cheap PCI tuner (originally marketed to watch television on your PC).

TSDuck is sometimes used with FFmpeg, which has similar principles but operates at different levels. TSDuck processes the transport stream layer and the signalling while FFmpeg is an audio/video stream processor. Combining the two tools in scripts is a common practice to produce specially crafted transport streams.

TSDuck is a suite of tools with many options and plugins. Because of its versatility, it can be complex to master, just like FFmpeg. However (and unlike FFmpeg), TSDuck comes with a comprehensive user's guide with all details, reference topics and examples.

TSDuck is also a programming environment. Being developed in C++, all features are available to C++ developers for third-party applications. Bindings are also available for Java and Python. As a typical example, a simple Python program can drive a live transport stream and manipulate the signalling in JSON format.

Like any open-source project, it is possible – and even recommended – to contribute to the development of TSDuck. Specialized plugins or signalling are welcome for integration in the code base. Code contributions pass through the GitHub pipeline where they are automatically built on different platforms and a complete test suite is run on each of them. The test suite is also locally available to debug your development.

TSDuck is available on Linux, macOS, Windows and all major BSD[1] systems. Its liberal BSD-2-Clause licence allows usage in open-source and proprietary applications equally.

NEW DVB CODECS

The TSDuck source code is structured in a way that permits additional capabilities to be easily developed and quickly integrated. To support AVS3 and VVC coded video, additional descriptors and identifiers were developed, each in its own self-contained C++ class that provides deserialization and serialization from binary streams and XML documents, in addition, decoding to human readable form. The XML serialization routines are primarily used to support the comprehensive TSDuck regression test suite that develops alongside the primary applications.

Two classes, named AVS3VideoDescriptor and VVCVideoDescriptor, were contributed to the TSDuck code repository to support processing of new signalling for these new video codecs. Existing functionality, such as the processing of component descriptors, was also contributed to ensure all aspects of a transport stream containing DVB next-generation video codecs could be correctly processed.

[1] Berkeley Source Distribution, a licence used to distribute open source, freeware and shareware projects

Thierry Lelégard is the founding author of TSDuck, as an open-source software enthusiast. He has worked for Canal+, Nagravision, STMicroelectronics and Orange and now works on microprocessor security at SiPearl. **Paul Higgs** is the chair of DVB's TM-I workgroup and one of the proponents of next-generation video codecs.


Finding a practical solution for operating DVB-I service lists

William Cooper (Service List Registry)

DVB-I promises to provide a standard way for traditional broadcast and online audiovisual media services to advertise their availability and for devices and displays to discover and offer them to users.

The idea is that a compatible client device can query an online server to request a list of available services and how to access them over various delivery networks.

The system works with existing distribution infrastructure and is simple to deploy. Anyone can set up a service list server. There is an open-source reference application and other implementations are also available. DTG Testing has developed a DVB-I test suite with reference metadata for conformance validation. Trials are already under way in markets including Germany and Italy.

POTENTIAL BARRIERS

However, speaking to industry stakeholders a year ago, it was apparent that there was no clear consensus on how a general system of service lists would operate in practice. This presents a potential barrier to broader adoption, particularly for consumer electronics manufacturers that operate across multinational markets. How does the client know where to look for the service list server in the first place? Without a common approach, the problem of service discovery has not really been solved.

How can the client trust the service list information? Without a system of authority, the display device, and therefore the viewer, does not know if the information provided is credible or reliable. Such a system also needs to be secure, with operational processes and procedures to ensure the integrity of the service and the dependability of the data.

To enable the adoption and deployment of DVB-I requires a scalable platform that is highly available and capable of supporting potentially billions of devices. The availability of service lists at a given address also needs to be secured for the lifetime of dependent products.

A single central registry, while potentially authoritative, could be politically impractical, given the various national and commercial interests involved and the territorial nature of media markets.

REGISTRY PROVIDER

To address these challenges, we incorporated Service List Registry Limited to offer a service discovery platform. First presented at DVB World in Brussels last May, it is based on a secure federated system that allows administration to be delegated to authorized parties, including service providers, platform operators, and national regulators. Service lists can reference third-party services, incorporate other service lists, or point to another service list server that is responsible for a particular region, platform, or service.

This means that an initial query request to the registry will result in a response with relevant services for a given target territory. Prominence and provenance of public media services can be preserved, supported by regulation where required by the relevant authorities.

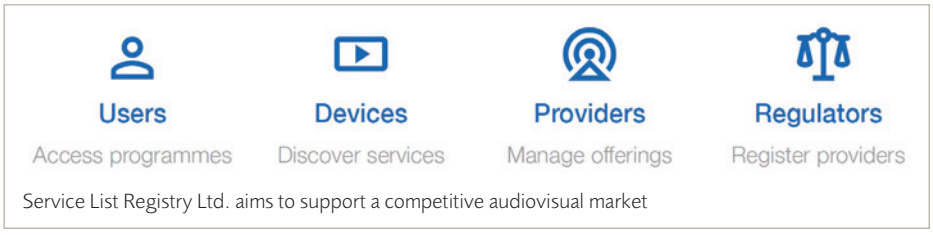
The model is comparable to the domain name registry system, which has supported the massive development of the internet and the world wide web.

Although the DVB-I standard also deals with programme listings information, the registry is only concerned with service discovery. It does not attempt to provide a programme guide or catalogue, which is better left to service providers, and it does not dictate how service information is presented.

A pilot programme enables early adopters to evaluate the service discovery platform and to administer and publish their own service list offerings at no cost.

An online demonstration is available on the website, and personal presentations have been provided to broadcasters around the world, including Australia and Japan. The ATSC has acknowledged that DVB-I is a candidate for a global service discovery standard.

This represents an elegant solution to a complex industry problem, enabling next-generation services in an open competitive market. The objective is to provide users with choice, convenience, and control, offering simple service selection on any screen.

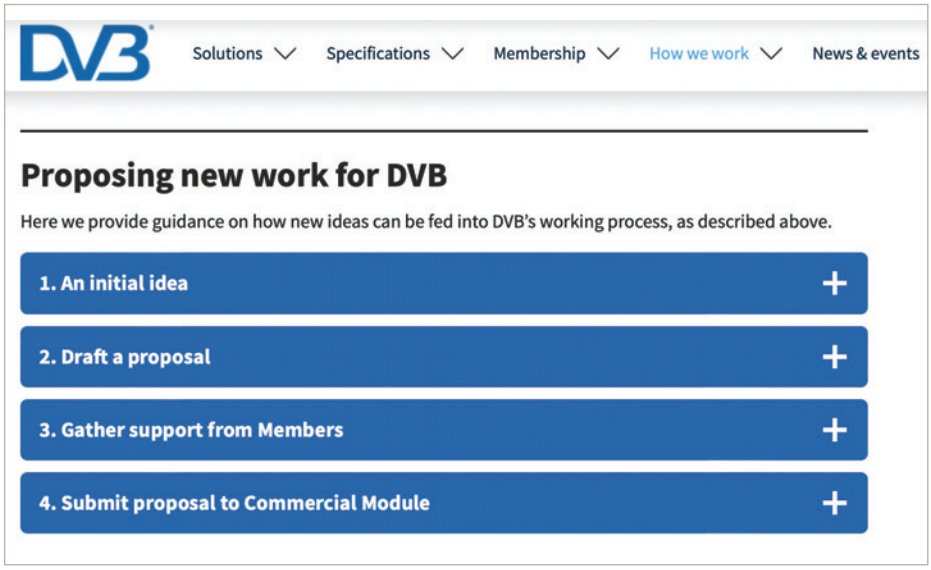


Service List Registry Ltd. aims to support a competitive audiovisual market

Dr William Cooper is an independent consultant who has worked at the intersection of broadcast and broadband television and video for two decades. He is the founding Chief Executive of the Service List Registry. Further information is available at slrdb.org.

Exploring future work for DVB

The DVB Commercial Module is always open to proposals for potential new work items. At present, there are three ongoing study missions that may lead to further specification work. Read about them below.
For guidance on how new ideas can be fed into DVB's working process, see: dvb.org/newwork



ENERGY-AWARE DELIVERY AND CONSUMPTION

Julien Lemotheux (Orange)

For many years, the impact of information and communication technologies on the environment went relatively unnoticed. But the effects are consequential and gaining attention. DVB started a study mission on Energy-Aware service Delivery and Consumption (EADC) in September 2022 to address this topic.

The objectives are to review and analyse how all relevant energy-related aspects can be taken into consideration in DVB systems. The group, which I co-chair with Erik Reinhard (InterDigital), will then identify the potential need for new or revised specifications to allow energy-efficient options during service delivery and consumption, in delivery networks and home networks.

During the initial phase of the study, we have built an overview of what is done in other ecosystems, thanks to contributions from DVB Member delegates or exchanges with external entities like Greening of Streaming or Einbliq.io (on their trial with Deutsche Welle). We then decided to launch a survey seeking more inputs from the industry, to generate a list of all ideas that could help to improve energy efficiency when using DVB technologies. This survey will be closed in March with the goal of submitting a report to the DVB Commercial Module in June 2023, providing an overview of actions already done in the DVB perimeter and suggesting use cases that would improve energy efficiency to be considered in DVB specifications.

Survey: surveymonkey.com/r/dvb-eadc

OBJECT-BASED MEDIA

Elfed Howells (Huawei)

Sparked by increased trials and service launches worldwide, the DVB Project is undertaking a study mission to gain insight and collect use cases for object-based media (OBM), which covers the delivery of multiple media elements (objects) that are related to the same programme.

Some objects are considered the default content, such as the standard audio or video, while other objects might be additions, such as audio description/signing/subtitles or an alternative language.

Today, most programmes contain at least two additional objects (e.g. audio description, subtitles) but many contain several more (such as visual signing, director's commentary, additional graphics, EPG links, trailers and references to online information).

OBM also encompasses media items that are related to the service, but not part of the default playback (cast and crew information, synopsis, still image or video trailers) and these are also part of the study.

In DVB systems today there are specifications for carrying the most common objects, e.g. subtitles, but these are only designed for a specific purpose and a common framework for multiple objects is not available.

The CM-SM-OBM group is examining how objects are being used in the industry and determining how existing specifications cover the carriage of multiple objects, and whether there are commercial drivers that justify further standardization by DVB. This includes the carriage of media objects, metadata, and rendering at each stage of delivery.

While we focus on the distribution of the media, questions about ease of use, accessibility, user experience, interaction and enabling presentation to and selection by the user are also in scope.

So far we have had presentations from Stornaway.io, BBC, ADM, IMF-UG, Fraunhofer IIS, MPEG, Dolby, Salsa Sound, Ateme, and Huawei, with more to come. An industry survey is now open and we encourage you to participate.

Survey: surveymonkey.com/r/dvb-obm

VOLUMETRIC VIDEO

A study mission on Volumetric Video kicked off in November 2022, chaired by Paul Higgs (Huawei). It is aiming to reach common understanding on service scenarios for volumetric video, including visual and audible aspects, industry evolution and standardization trends. It will identify potential standard gaps within DVB or industry-developed specifications and standards.

The group will develop a report on use cases and service scenarios (sports, opera, tourism, etc.) as well as providing suggestions for a framework to support Volumetric Video services. Opportunities for collaboration with other relevant groups will be highlighted.

“The unconference format worked very well.”

“...topics and opinions that would never have been shared in a traditional one-to-many presentation style...”

“Enthusiastic, smart people engaged in open discussion...”

“...appreciated the laser-sharp focus...”

“...best possible format to leverage attendee expertise...”

“...an inspirational event...”

“...every session I attended was relevant to my interests and I could usefully have attended many of the others...”

“...very few people trying to sell anything...”

“...opportunity to network, listen and dream together...”

“The best conference I have ever been to.”

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