MEDIA TECHNOLOGY & INNOVATION

ISSUE 50 • DECEMBER 2021

tech-*i*

Testing what's possible with 5G-based production

Plus

- **How 5G Broadcast could help save lives**
- **RTBF's Cécile Gonfroid on putting humans at the heart of the transformation**
- **Looking back at 50 issues of tech-*i***

and more...

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Issue 50 • December 2021

Cover story: As part of its continuing tests of 5G for media production and distribution, Spain's RTVE took a portable small-cell network to an open-air theatre for video coverage of a live radio play. See page 6.

Editor-in-Chief: Antonio Arcidiacono
Managing Editor: Patrick Wauthier
Editor: Eoghan O'Sullivan
tech@ebu.ch

Design: Louise Tait

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How do we win the war for media and innovation talent?

Antonio Arcidiacono, Director of Technology & Innovation, EBU

To guarantee the future growth of public service media, and prevent the global media companies from using their market power to absorb the limited talent available, we need more than ever to invest in our future. This is about the skilled people whose presence in our organizations is a prerequisite for mobilizing and sustaining innovation.

We need to redouble our efforts to create growth. The defensive stance that is the more typical response to a critical period cannot be what drives our efforts. It is only by offering a growth perspective to the youngest generations that we can gain their belief in what we do and, later, the energy injection that is necessary to take us to a stimulating and sustainable future.

A NEW GENERATION

We are today engaged in a war for talent; winning that war requires a renewed effort to educate a new generation of young media scientists, engineers, technologists and creators. This generation of digital natives is no longer confined to working in one domain, which in the past would have dictated their academic path. Their common humanist background is founded upon an inherent understanding of the importance of trust, rigour, and excellence, of having an open and curious mind, and the ability to engage in deep analysis.

To build our future and guarantee a continuous and increasing flow of energy, we now require new talent, ideas and initiatives at the edge of innovation. To start with we must target deeper collaboration between EBU Members, our T&I team and leading European universities interested in media

innovation and related educational activities, as well as other private institutions interested in joining such an initiative.

More concretely, the idea is to actively foster the creation of new curricula in media innovation, whether as graduate courses or vocational training. In addition to cutting-edge technical training, such courses must stimulate the creativity of younger generations, with additional focus on media literacy to develop fundamental skills in producing and managing media content. As we evolve towards ever more immersive experiences, including the prospect of participating in a virtualized 'metaverse', citizens must be empowered with knowledge that gives them mastery over the media they consume, instead of being dominated by it.

HUMAN SKILLS

The idea of combining the development of creative and technological skills does not necessarily mean that everyone should be able to shine at the same time in technology and artistic creativity. Rather it is about promoting a positive dialogue across the full spectrum of human skills. (I say this as an engineer with a creative spirit: I studied piano for many years without taking the path towards being a professional pianist. This creative endeavour gives me an additional pleasure and insight when listening to any music but also a wider vocabulary when it comes to exchanges with colleagues in the creative sector.)

It has become more important than ever to provide the knowledge and ability to any university student, and in fact any citizen, to use tools that underpin our new ways of working, accelerated by the COVID crisis, as well as to interact in this rapidly changing media world. This imperative will strongly influence how media R&D&I will be structured. We need to proactively help setting the reference strategies and related technologies that will get us there.

This new ability to attract, reach, communicate and debate represents an additional growth opportunity for society, limiting disinformation, improving citizens' education, and giving voice to a larger share of the population. We must take steps now to ensure that our youngest generations will not only help define their own future but also be actively involved in the democratic evolution of society.

In the end, this is a joyful and invigorating challenge: extracting and guiding the energy of new generations to rejuvenate our world and reinvent our future!

P.S. I hope you enjoy this, the 50th issue of tech-*i*. Since 2009 it has chronicled a period of profound change in our industry (see pages 10–11). Let's see what we will achieve together in the next ten years, pushing forward our digital transformation!

The Emmys have landed!

As reported in these pages last March, the European Broadcasting Union has been awarded three Technology & Engineering Emmy® Awards for excellence in engineering creativity, recognizing technologies that were collaboratively developed by the EBU and that have shaped or underpin systems widely used by the broadcast industry today. The famous statuettes arrived in Switzerland last month and are photographed here with members of the EBU Technology & Innovation team.

As a reminder, one of the awards recognizes the EBU's role in the creation of the Advanced Authoring Format (AAF), an interchange file format that paved the way for cross-platform post-production workflows. The second honours the standardization and commercialization of broadcast, hybrid electrical and fibre-optic camera cable and connectors, a design for physical interconnect solutions that helped to accommodate the growing bandwidth requirements in digital media production systems and has since come to be relied on by vendors, broadcasters and media creators around the world.

The final of the three Emmy Awards marks the EBU's contribution to work on Common Encryption, a fundamental technology design that enabled the deployment successive generations of increasingly sophisticated conditional access systems as part of new services on satellite and cable.

PTS 2022 to embrace sustainable and virtual worlds

The Production Technology Seminar returns from 1 to 3 February, with a programme that is firmly focused on emerging tools and techniques for content production. Whether you're curious about AI-based content production, end-to-end authentication of content provenance, object-based media, the use of 5G networks for production, or virtual studio environments, you'll find both inspiration and education on the agenda at PTS 2022.

The opening keynote will come from Emmy® Award-winning director and artist Francesca Panetta. She is an industry leader in the world of immersive and experimental storytelling, using emerging technologies to innovate new forms that have social impact. She has pioneered new forms of documentary and journalism through her innovative, richly layered and thoughtful work.

The three-day event will have a packed programme of keynotes, use cases, technology talksand discussion panels. Experts from EBU Members will figure strongly, as usual, along with new voices and faces from outside traditional media production circles. Recognizing that sustainability is now an overriding concern that cuts across all areas of activity, every session will include reflections from the session moderator on how sustainability applies to the area in question.

It is planned that PTS 2022 will be the first EBU Technology & Innovation event to have physical attendance since the beginning of the COVID-19 pandemic. Capacity will be limited,however, and it will be run as a hybrid event allowing online participants to follow the proceedings remotely.

For the complete programme and registration, visit: tech.ebu.ch/pts2022

5G Broadcast and DTT can share spectrum and infrastructure

A 5G Broadcast system could be safely introduced alongside DTT in the UHF band, and existing broadcast towers could be used to significantly enhance the coverage and minimize the deployment cost for this new technology. These are the headline conclusions of a pair of landmark EBU reports published in recent months.

Both reports use the term 5G Broadcast as shorthand for LTE-based 5G Terrestrial Broadcast (ETSI TS 103 720). It is a new broadcasting system to be deployed in a downlink-only frequency arrangement, often called standalone downlink-only (SDO), using 5G components as in wireless broadband networks but, importantly, supporting free-to air and 'receive-only mode' services and devices without requiring a subscription to a mobile network operator.

One of the reports, titled ***Compatibility between 5G Broadcast and other DTT systems in the sub-700 MHz band* (EBU TR 064),** looks at how 5G Broadcast and existing DTT could coexist in the UHF band that is currently used by DTT alone. It evaluates three possible scenarios for the introduction of 5G Broadcast in the sub-700 MHz band and concludes that the reuse by 5G Broadcast of DTT frequencies already coordinated under the GE06 agreement seems to be the most practical way for early introduction of 5G Broadcast in that band. The report also shows the benefits of standardizing an 8 MHz bandwidth for 5G Broadcast to maximize the efficiency of spectral usage.

The other report, ***5G Broadcast Network Planning and Evaluation* (EBU TR 063),** confirms that existing broadcast infrastructure could have a role to play in 5G Broadcast and that testing should continue in this area. Existing broadcast towers contribute to cost efficiency, but for good coverage in all environments, they should be complemented with cellular networks, particularly in urban environments, the report says.

EBU TR 063 also stresses that due to practical and regulatory constraints at national and regional boundaries, hybrid 5G Broadcast networks could be partially operated in MFN (multi-frequency network) mode. Although this lowers the spectral efficiency below that achievable by pure SFN (single frequency network) setups, the gains would outweigh the losses. The report also assesses the capacity (in bitrates) offered by the various network topologies.

Both reports are available for download at: tech.ebu.ch/publications

Recommending a solid foundation for UHDTV development

The EBU UHDTV Strategy Support group recently delivered two recommendations that provide valuable ready-to-use guidance. The recommendations, EBU R 153 and R 154, are a response to the lack of a common baseline for a UHDTV exchange format. The first is a basic set of recommendations for UHD-HDR *live signal contribution* via SDI or IP interfaces, while the second concerns *non-live content exchange*.

While only a handful of EBU Members are offering UHDTV content at present, many have begun to formulate strategies to ensure they are prepared as the format becomes more widespread. As major global players invest heavily in their UHD content offer, the demand for increased video and audio quality will grow, with public service media being expected to respond. An EBU group created in March this year, led by Technical Committee member Karl Petermichl (ORF), quickly identified a need among Members for practical advice on how to implement UHD and HDR (high dynamic range).

The result of five months of intense work by participants from a wide range of EBU Members, the two recommendations represent a 'best of' compilation of earlier work on the topics of UHDTV, HDR and Next Generation Audio. (With regard to audio, the recommendations adopt the term used by SMPTE, Metadata-Guided Audio.) The guidance should be used when no other agreements between two parties for UHDTV programme exchange are in place. The new recommendations can make life easier for day-to-day content exchange between EBU Members, other broadcasters, service providers and production companies.

These recommendations can also be used as a starting point by broadcasters and production companies just beginning in-house UHD-HDR content production or processing, and who need a simple and concise set of parameters and rules that can be used for tender and/or commissioning purposes.

TECHNOLOGY CHOICES

Both documents recommend HLG (Hybrid Log Gamma) as the HDR method, as it is the approach most widely used in current broadcast installations in OB trucks and facilities in Europe. It was also the HDR format for major sporting events in 2021.

The recommendations offer concrete and practical advice for live exchange over SDI and IP, as well as for Metadata-Guided Audio. For audio, the emphasis was on translating the existing strong theoretical base into guidance that can underpin practical adoption.

See: tech.ebu.ch/publications *(filter for Recommendations).*

Using 5G network slicing to create new public service opportunities

Building on earlier experiences with 5G-based live productions, RTVE investigated how a portable small-cell network could help coverage of events in isolated locations, writes **David Corral Hernández**.

The latest innovation test from RTVE aimed to provide a solution to a very common challenge: how to deliver reliable and high-quality broadcasts from sparsely populated and poorly connected locations. On this occasion, the opportunity was provided by a radio play, *La reina muerta*, produced by Radio Nacional de España (RNE). It was performed last July in the town of Almagro, close to Ciudad Real, as part of the International Classical Theatre Festival.

The RTVE team aimed to use cutting-edge technologies, including 5G, to demonstrate RTVE's public service capacity to give a voice to the least populated rural areas and to broaden cultural coverage. The project also served as a testing bed for the use of innovative technologies in rapid deployments, with limited resources and personnel.

The distribution of *La reina muerta* to RTVE's website, social networks and on linear broadcast television was done using a cloud-based live video production platform called TVU Producer. The audio from RNE's conventional radio broadcast was mixed with images captured by a camera connected to a TVU One 5G mobile IP video transmitter, and by several 5G mobile devices, integrated and synchronized in the broadcast through a mobile app.

Live video was captured on a camera with a 5G mobile IP video transmitter connected to the portable 5G base station (inset)

NETWORK SLICING

RTVE's regional centre for Castilla-La Mancha and the RTVE Innovation department joined forces to create a portable 5G network with network slicing capabilities at the *Corral de Comedias* open-air theatre in Almagro. Unlike other similar initiatives, rather than being automated within the network's traffic management system, the network controller was integrated into the local base station, an approach that guarantees bandwidth and high-quality transmission services. The project also served to test the capabilities of network slicing, a feature of 5G that allows networks to be segmented in order to assign users (generally companies) different virtualized and independent "channels" on shared physical infrastructure.

Based on the experience gained through this project, RTVE believes that having a portable small-cell, such as the one provided by Telecom Castilla-La Mancha, will enhance mobility, creating new opportunities to plan and execute 5G coverage, especially for live events, wherever it is needed. The aim is to shape these technologies and their possibilities so that, as far as possible, they can be integrated into everyday workflows and allow us to make further progress in other areas, such as edge or high-quality broadcasting.

Different RTVE departments have participated in this broadcast and first network slicing test, including staff from RNE, regional centres, Barcelona and Innovation. It was another test for the most experienced 5G TV team in Spain – and probably one of the most experienced in Europe – in a demonstration of the public broadcaster's commitment to public service, rural territories, culture and technological innovation.

The result of the broadcast can be watched at the following link: **tinyurl.com/rtve-5g**

This project was made possible through Red.es, a government-owned entity that drives the digital agenda for Spain. RTVE collaborated with Telecom Castilla-La Mancha to apply for funding under the Red.es second call for 5G pilots.

Better safe than sorry – how 5G Broadcast can save lives

Looking back to the catastrophic flooding that happened in Germany last summer, **Jochen Mezger** of ARD's Competence Center for International Frequency Management explains why the fight to protect UHF spectrum is about much more than content.

On the night of 14 to 15 July, the water came – a lot of water. The Ahr river in the west of Germany, usually peaceful and just 60 cm deep, became an all-devouring monster. At 19:00 the historic high of 3.21 m was exceeded. One hour later, the uppermost measuring point was overrun. The last value transmitted before the measurement system failed was 5m. The presumed highest level during the night was about 7 m.

The disaster alarm was triggered. The masses of water indiscriminately washed away people, houses, bridges, and rail tracks, flooding large parts of the region. All in all, the floods caused a death toll of 133 people, injuring hundreds more and affecting 42,000 in total, among whom 17,000 lost nearly everything.

COLLAPSE OF PPDR

The situation was aggravated by the fact that the power supply quickly failed and, as a result, the mobile networks as well as the digital PPDR (public protection and disaster relief) networks collapsed. In the end, only the elevated analogue PPDR systems and the broadcast transmitters remained as means of communication. In particular, audio broadcasting was important to inform, help and – yes, very important – bolster people in such an existential crisis. People used their battery-operated radios or went to their hopefully still existing cars, switched on their receivers, and listened.

Many of the mobile base stations in the area were down, either due to the flood itself or due to power outages. Mobile networks are commercially driven network infrastructures without obligations to maintain operation in such adverse circumstances. As a consequence, there are no substantial battery backups, no mains replacement systems, and no resilient infrastructure to maintain operation.

In contrast, many broadcast transmitters could rely on their diesel engines, two-way transmission links, and further emergency operation facilities like on-site redundancy equipment.

A lesson definitively learned from the catastrophe was that the widespread and intensively used smartphones carried in every pocket became useless as the mobile networks went down. These devices are capable of receiving not only audiovisual content but also graphics and data in order to display, for example, weather maps, evacuation routes or videos on where to shelter and protect others and yourself. In principle, these devices could enable much richer and more comprehensive emergency messages than traditional audio broadcasting.

Thomas Lohnes/Getty Images

The July 2021 floods in western Germany affected 42,000 people

REACHING SMARTPHONES

5G Broadcast* can be a solution as it is a fully self-contained broadcasting network that can rely on the existing well-established emergency transmitting functionalities described above. At the receiver side, smartphones can easily be charged with a powerbank or by using the car battery.

Many broadcasters are considering the introduction of 5G Broadcast as a new technology to address, in particular, smartphones and tablets. This would result in a "unique selling proposition" as it would be the only public system capable of transmitting to and being received on these devices for a couple of days – even under catastrophic conditions.

And don't forget the hearing-impaired: they could tremendously benefit from such a system, that uses simultaneously voice and video as a communication means.

Of course, 5G Broadcast can also be used for everyday distribution of audiovisual broadcast content, services etc. To realize 5G Broadcast, adequate spectrum in the fiercely contested UHF band is indispensable.

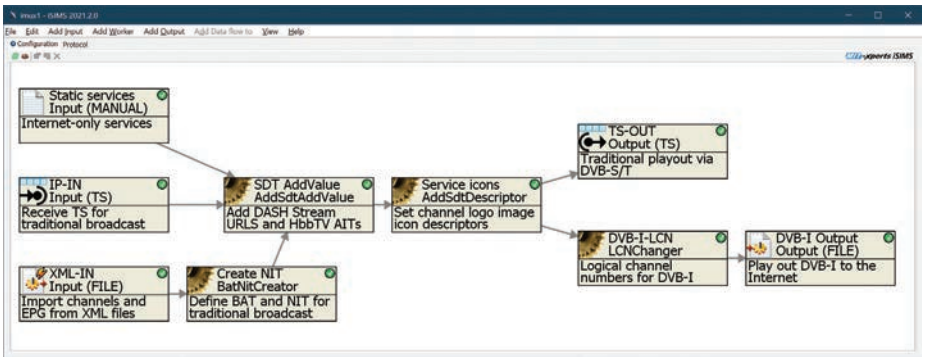
Climate change will increase the occurrence of disasters like floods, fires, snowstorms or even tornadoes in Europe. 5G Broadcast can at least mitigate communication blackouts. Better safe than sorry.

*5G Broadcast here refers to LTE-based 5G Terrestrial Broadcast

How ARD is bringing broadcast and internet together through DVB-I

Based on his company's experience with ARD in Germany, **Johannes Schmid** (MIT-xperts GmbH) explains how DVB-I opens new opportunities.

DVB-I opens the door for bringing broadcast services to the internet in a standardized way, but it is more than that: it allows broadcasters to 'embrace and extend' IP-based streaming.



Typical data flow for processing DVB content, enriching it, and converting it to DVB-I

CONVERTING EXISTING CHANNELS

Usually, the first step for a broadcaster is to bring the current DVB-S/C/T-based services to DVB-I. It is important to understand that DVB-I is not internet-only: it serves as the bridge between both worlds. In this first step, you can use DVB-I to provide a standardized list of your traditional broadcast channels via the internet. In this case, DVB-I provides all necessary information to find those channels in the broadcast world, something like the NIT (Network Information Table) in traditional DVB systems.

As ARD, the largest public broadcaster in Germany, already uses the MIT-xperts iSIMS SI/PSI server for its broadcast-related service information, this transition was the next logical step. Using the latest version, you can easily export all your DVB services to DVB-I and publish them on the internet. The iSIMS server converts the broadcast data, such as the NIT, SDT (Service Description Table) and EIT (Event Information Table, containing the electronic programme guide), to DVB-I and automatically keeps both worlds in sync.

Translating your existing data to DVB is only the first step. Your DVB-I audience now knows about your channels and what is currently running on those channels, but without a traditional receiver, they cannot watch them.

The next step is to get your internet livestreams up and running. Thanks to the broad usage of HbbTV interactive TV throughout the ARD, we already had DVB-DASH livestreams in place. For DVB-I, you only need to assign a livestream URL to each channel. Adding a channel logo to each of your services at the same time really improves the look of your EPG and channel list.

The next step is to enrich your EPG with images too. Luckily ARD already has images for most of its EPG entries, intended for print media and various internet-based EPGs, so it was an easy task to also bring those images to the SI/PSI server, which converts them to DVB-I. Traditional broadcast services can also benefit from this: as your SI/PSI server now knows about channel logos and images for the EPG, you can play out this information via DVB-S/C/T too. This allows connected devices from the traditional broadcasting world to display this new information, bringing both worlds even closer together.

Finally, you can now bring your interactive TV content, including video-on-demand apps, to DVB-I. In Germany, we are big supporters of HbbTV, the standard for HTML-based interactive TV. All you need to do is to convert your existing AIT (Application Information Table) to an XML-based AIT and publish it via DVB-I, a task the iSIMS SI/PSI server can handle. With this final step, your transition to DVB-I is complete.

A NEW ERA

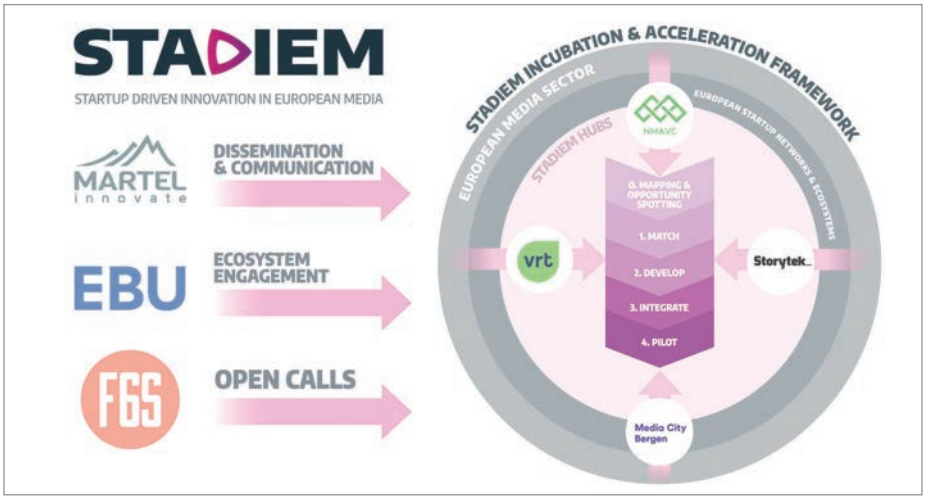
Beyond this, DVB-I opens entirely new possibilities to extend your reach: internet-only channels with live streams and video-on-demand content; visual radio, enriched with news, traffic information, the current playlist, etc.; or event channels for soccer matches, concerts, and any other content you have available. You can also now think about personalization services, like genre-based channels or tailored mixes of live and on-demand content based on individual user feedback.

DVB-I opens a new era for broadcasters bringing their content to the internet. It allows more personalization and more freedom for the individual user while still staying with a trusted broadcast brand (like ARD in Germany). The broadcaster stays in control of all its metadata and is able to broadcast dynamic channel lists.

STADIEM: calling innovators to enhance Europe's next-generation media ecosystem

In taking the lead on ecosystem engagement for the STADIEM project, the EBU has a capital role in the creation of a dynamic, innovation-focused community, writes **Carmela Asero** (EBU).

Running from 2017 to 2019, the EU-funded MediaRoad project boosted the development of a nurturing ecosystem for media innovation in Europe. Building on the experience of leading that project, the EBU is now part of STADIEM (stadiem.eu), another Horizon 2020 project, which kicked off in October 2020. STADIEM offers a competitive acceleration and co-creation programme bringing start-ups, scale-ups, investors and media organizations together to foster the development of next-generation media solutions.



START-UPS & SCALE-UPS

Throughout its four-stage programme of matching, developing, integrating and piloting, STADIEM provides start-ups and scale-ups with relevant skills, information and knowledge (including market and consumer specifics), insights into available funding and scaling opportunities, as well as connections with corporate networks. The EBU's role is to lead the task of ecosystem engagement. This involves engaging with stakeholders across Europe to connect promising start-ups/scale-ups active in the media sector with a large network of established public service media organizations interested in adopting and deploying their products and solutions.

Alongside the EBU, the project consortium involves six other partners: EBU Member **VRT**, the coordinating partner; **Media City Bergen** (MCB), a leading international hub for media and technology innovation; **Next Media Accelerator** (NMA), which leads a pan-European start-up programme for innovation in media; **Storytek**, an accelerator and creative innovation hub with deep audiovisual sector knowledge; **F6S**, the world's largest community for tech founders and growth companies; and **Martel**, an SME with over 20 years of experience in managing research and innovation projects and their communication.

The acceleration and co-creation framework consisting of the four partner hubs (VRT, MCB, NMA and Storytek) aims to give the selected start-ups/scale-ups the best possible support in Europe in upscaling. The current batch of 16 start-ups/scale-ups that are co-creating media solutions with their corporate partner covers a range of relevant and challenging topics. The majority work on topics related to *data, AI, machine learning and synthetic media* (Ceretai, Smartocto, Web64, aiconix.ai, Datavillage, Utelly, Trension, FanSifter, Visualyst) or *content creation and distribution* (Cutnut, On-Hertz, Frameright, Tinkerlist.tv). The others are developing solutions on *archiving* (The Chainless) and *monetization* (Nowtilus, FilmChain).

A FEW EXAMPLES

Here are three examples of partnerships being supported through STADIEM:

- With VRT, Ceretai is working on a platform that automatically analyses diversity in audiovisual content. By measuring diversity and equality in a transparent way, media organizations can take informed decisions and strengthen an inclusive and equal media offering. Ceretai is also in discussions on a possible collaboration with the EBU's diversity, equity and inclusion team.
- In making more content accessible to a wider audience, the use of language dialects becomes a barrier. In collaboration with Russmedia (Austria), aiconix.ai aims to improve dialect recognition for content creators, to support them in better transcription, subtitling and translation.
- The Chainless uses AI to recognize faces, scenes, segments and texts very accurately. They are working with ProSiebenSat.1 (Germany) on classifying and archiving audiovisual content, which, as a result, can be automatically tagged and personalized for the end user.

STADIEM's second open call is scheduled for publication in December 2021. Follow the project's social media channels to stay updated: stadiem.eu/contact/

The story so far: 50 issues of tech-*i*

As the EBU's quarterly magazine focused on media technology and innovation reaches its 50th edition, **Eoghan O'Sullivan** has selected one cover from each year to illustrate the broad range of topics covered since the first issue appeared.

tech-*i* was born in September 2009. Lieven Vermaele, who was then Director of the EBU Technology & Innovation Department, wrote that tech-*i* would complement the website:

"The newsletter is intended to not only serve EBU Members, but also the broader media community. It will bring you a regular overview of important evolutions in media production and delivery technology as well as news of important projects in broadcasting and the internet, and the clear positions of the EBU."

Issue 1 – September 2009

The first tech-*i* cover featured a 3D camera concept from Panasonic, in connection with an article suggesting that the time may have been right for 3DTV to finally take off. That prediction turned out to be wide of the mark, but an interest in different ways of telling stories has remained, not least with the advance of virtual, augmented and mixed reality formats.

Issue 4 – June 2010

The creation of the HbbTV Association was an important enabler for the subsequent growth of hybrid services that have enhanced broadcasting with additional internet-delivered content. The EBU played an important role in ensuring that a standards-based solution was developed, easing the path to deployment for public service broadcasters. In tech-*i*, IRT's Klaus Illgner stressed the urgency of the situation, writing that if HbbTV failed to take off, broadcasters would "lose the last opportunity to provide a seamless user experience of linear and non-linear services while maintaining control of their branding of non-linear services to the consumer."

Issue 9 – September 2011

"Will production be in the clouds?", asked the cover of the September 2011 issue. IBM's Bart Bogaert warned that media companies that didn't "join the digital revolution of so-called cloud computing" would almost certainly disappear. He wrote about private versus public clouds and the coming virtualization of services. The cloud was to become a regular topic in tech-*i* and at EBU conferences in the years that followed but, arguably, it took a global pandemic to really bring cloud-based production into the mainstream.

Issue 11 – March 2012

The cover of issue 11 was inspired by the famous Beatles album and took its cue from an article on research into the use of "white spaces", unused parts of UHF spectrum. It was thought that these could potentially be used to partly solve the problem of spectrum scarcity. The EBU was watching the topic carefully to assess how any solution that emerged would affect the ways that broadcasters already used UHF spectrum. While we hear less about white spaces today, the discussion of how spectrum should be allocated has become, if anything, more intense.

Issue 16 – June 2013

A striking photo of the wind turbine at Sky Studios in the UK graced the cover of the June 2013 issue of tech-*i*, which included a pair of articles on the topic of sustainability. In addition to a report on Sky's pioneering work to "green" its facilities, there was also an update from BBC's Simon Tuff on an EBU group that had been formed 18 months previously to focus on sustainable technology in broadcasting. Tackling climate change has become an ever more urgent challenge, one that the EBU continues to address through various activities. As of issue 44, every edition tech-*i* has included at least one article under the banner of *Sustainability Matters*.

Issue 21 – September 2014

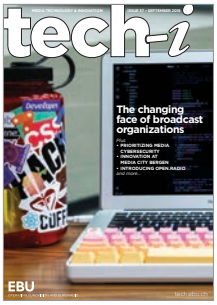
This edition of tech-*i* highlighted some of the earliest broadcasts of 4K UHD content, with reports on RTVE's trials on digital terrestrial television in Spain and the first FIFA World Cup to include a 4K feed. In both cases, the HEVC video codec was a key enabler.

It was the start of a long journey that continues to this day, with UHD only now starting to become more widespread. The EBU has a solid track record in ensuring its Members can benefit from big steps forward in video and audio quality, ultimately seeking to add value for audiences.

Issue 26 – December 2015
Live IP production appeared on the cover of tech-*i* for the first time in December 2015, and it went on to be a key work area for the EBU in the years that followed. Belgium's VRT, among others, did important early work on this topic, work that was recognized by the inaugural EBU Technology & Innovation Award the following year. IP production would return to the cover again in December 2017 and June 2019, as the standards (notably SMPTE ST 2110) evolved and the first big implementations rolled out in new broadcaster facilities.

Issue 30 – December 2016
"The UHDTV experience", wrote David Wood in this issue of tech-*i*, "will be significantly better if an advanced sound system is used alongside the improved image quality." Next Generation Audio – or NGA – was to appear regularly in tech-*i* from this point forward, particularly in the context of work to ensure that broadcasters would be able to implement production workflows independent of the codecs used. The EBU's development of an open renderer for NGA, subsequently adopted by the ITU, was an important milestone.

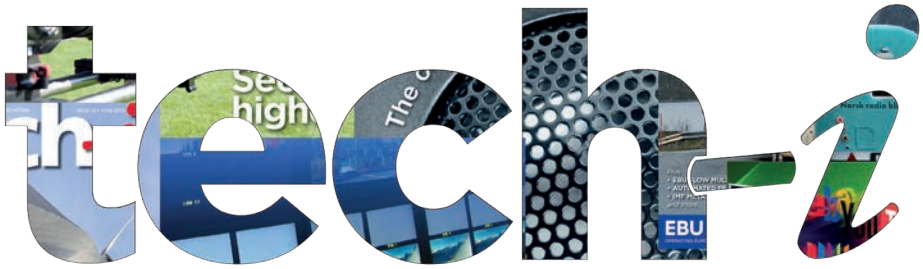
Issue 31 – March 2017
Norway made history when it began switching off its FM radio network in January 2017. The caravan pictured on the cover of the March 2017 issue of tech-*i* toured the length and breadth of the country throughout that year, with a roadshow that helped to address the concerns and questions of the public. Switzerland looks set to be the next country to complete the transition to DAB+, no doubt with many other countries watching with interest once again. And tech-*i* will continue to track the evolution of radio delivery.



Issue 37 – September 2018
In September 2018, we marked the increasingly central role of software engineering in public service media, and especially the influence of the *culture* of software engineering, as DevOps and scrum became part of the landscape. With collaborative projects like the PEACH personalization engine and LIST, the Live-IP Software Tool, the EBU T&I Department had already ramped up its capacity to lead the delivery of software-based tools, a trend that has intensified in the years since.

Issue 39 – March 2019
There has been no shortage of discussion on 5G over the last five years or so. Nevertheless, it seemed like the right time, early in 2019, to recap where the media industry stood with respect to the emerging technology. The EBU's Darko Ratkaj took on the task of explaining what 5G was and why it was relevant for broadcasters. Finding a cover photograph to capture a technology that had not yet been deployed was a challenge. In the end, we chose this image of a rural teleworking idyll. Little did we know that teleworking was to become the norm for just about everyone, for a while at least, a lot sooner than expected!

Issue 44 – June 2020
By the second quarter of 2020, the video-conferencing grid view had become part of the daily experience for a huge slice of the workforce. It also provided us with the inspiration for our 'COVID-19 cover', where we sought to somehow illustrate the disruption and acceleration that the pandemic had brought to the world of media and the world at large. It provides snapshots of the ingenuity of EBU Members, interspersed with some of the images that dominated our lives. It was break with our usual approach for the cover of tech-*i*, but we felt the circumstances called for it.



Taking collaborative action against the media cybersecurity threat

This year's EBU Media Cybersecurity Seminar, held on 12–13 October, made clear the urgent need for media companies and vendors alike to take action, writes **Lucille Verbaere**.

Cyberattacks are a growing threat for all industries and individuals and the media are no exception. Security in media needs to be greatly improved by wider adoption of existing cybersecurity recommendations and standards. This was clearly demonstrated during the 2021 EBU Media Cybersecurity Seminar (MCS), which attracted more than 230 attendees.

GROWING THREATS

First, our internet-facing services: Internet.nl tested a batch of EBU Members' web and email servers and found that most EBU Members or their providers did not implement modern internet standards or did not configure them correctly. Less than 5% of the servers tested used DNSSEC, which ensures it is really your site a user is visiting, and that the emails they receive really come from a sender at your organization. Only 12% of email servers implemented the recommended protocols to prevent mail spoofing (DMARC, DKIM and SPF), whereas current research shows that a large majority of cyberattacks, and in particular ransomware, start with an email.

Next, our core media systems: these systems are now connected to the IP world, bringing many benefits for production and distribution but also exposing media to security threats. However, media system vendors often prioritize the development of new functionalities over the implementation of security in their products. And media companies do not make security a hard requirement in tenders, fearing they will fail to find a system that fulfils their requirements if they do. Additionally, users in media do not always configure their media systems properly to make them secure, or do not have the necessary resources and time to patch them with their latest versions and operate them securely.

It took the IT industry decades to reach the existing cybersecurity maturity. The media industry could get there more quickly through cooperation, building upon established IT best practices and experience and implementing existing standards and recommendations, such as EBU R 143.

SHORT-TERM ACTIONS

At MCS 2021, broadcasters, vendors and experts designing IP-based media standards gathered in a roundtable to discuss concrete short-term actions to improve security in media. First, it is key to raise awareness across the industry and train people so that security is rooted in all developments and procedures. Developers and users should be encouraged to attend workshops and courses offered by industry organizations.

Second, vendors and broadcasters should collaborate closely to put in place effective vulnerability detection and remediation. Media systems should be continuously tested for vulnerabilities. Critical vulnerabilities should be fixed, and systems patched regularly. The security scans that were undertaken at the JT-NM Tested event in 2019 could be done on a larger scale, on all kinds of media systems. A secure test environment could be made available remotely by an entity like the EBU or AMWA to enable self-testing.

Lastly, vendors should share a clear roadmap for how they improve security in their organization and their products. A phased approach could be agreed with broadcasters, defining minimum requirements for a given type of equipment and the associated risk. Security level agreements should be put in place with and between vendors of interdependent solutions.

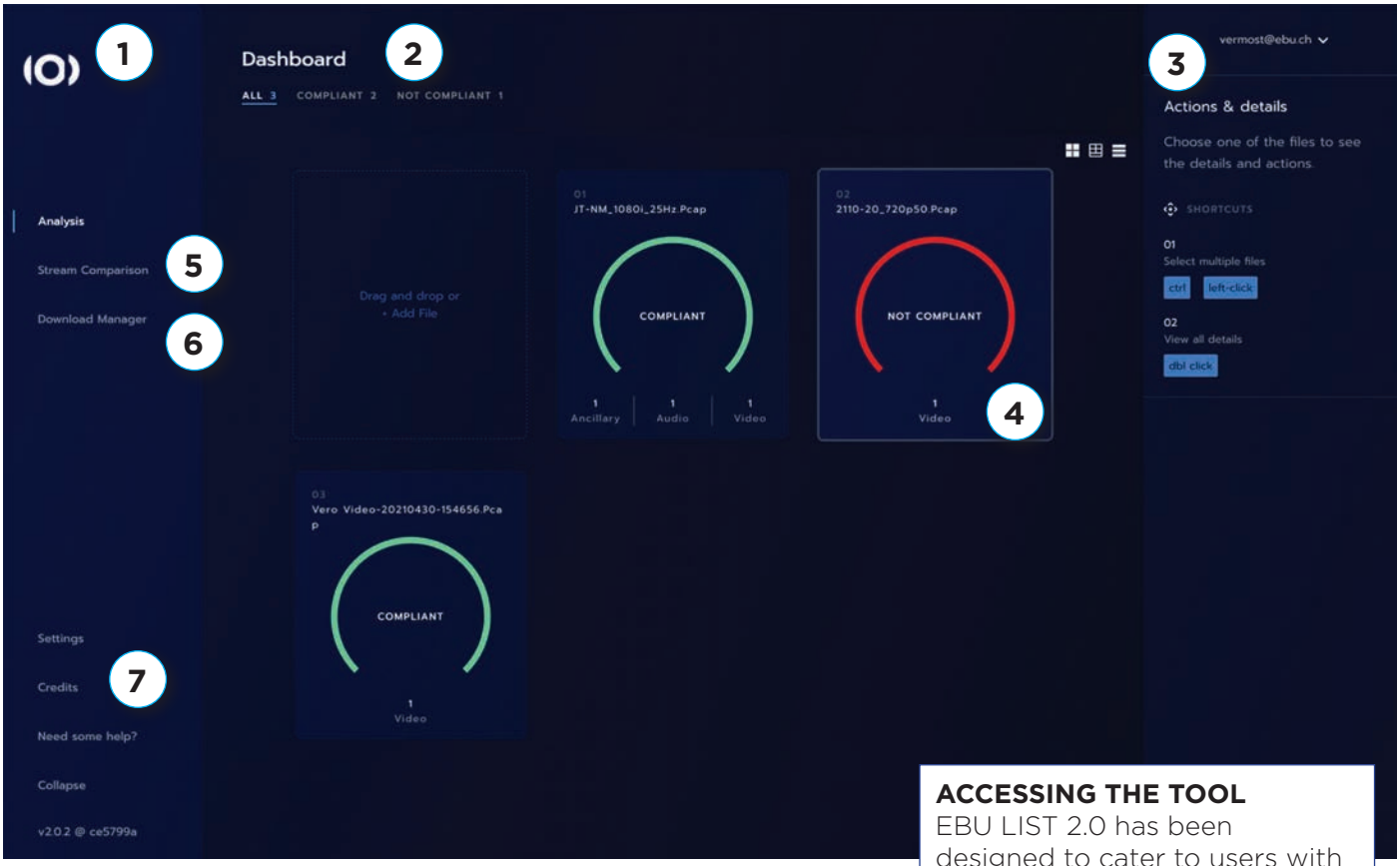
By cooperating as an industry, we can make it less painful than strict regulations will for sure do in a near future.

EBU Members can access the presentations from the Media Cybersecurity Seminar 2021 here: **tech.ebu.ch/events/mcs2021**

Thanks to Gerben Dierick (VRT), Gerben Klein Baltink (Internet.nl) and Rainer Jochem (SR) for their input to this article.

EBU Live IP Software Toolkit – more features, more user-friendly

EBU LIST – with a new version just released – has become the industry's go-to solution for media-over-IP test and measurement. Built by and for broadcasters, it is open source and incorporates the latest industry standards for live IP production. LIST 2.0, released in August, has been rebuilt from the ground up, with a brand-new user interface and lots of new functionality. Visit: tech.ebu.ch/list



1. A clean and modern interface simplifies the tool and makes it accessible to a much wider pool of potential users.
2. The home dashboard provides an at-a-glance view of whether or not a stream is compliant.
3. The right-hand panel brings up helpful tips on how to use the tool, along with shortcuts that can be used on the current view
4. Double-click a stream to bring up detailed analysis of the tests that have been run, along with a Stream Explorer and better, more detailed graphs than were available in Version 1.0.
5. The Stream Comparison functionality has been expanded greatly, with options to compare streams before and after processing or two versions of the same source stream, as well as to see whether a pair of streams are completely redundant, or – perhaps most usefully – to check audio to video synchronization
6. A Download Manager allows you to easily download the streams that you have uploaded.
7. Quickly check whether you're using the latest version and adjust user settings related to language, privacy and the analysis profile used.

ACCESSING THE TOOL

EBU LIST 2.0 has been designed to cater to users with different requirements and levels of experience. The most experienced users might wish to download a Docker container and run LIST on their own local machine or to take advantage of the API to integrate it into existing workflows or ease the workload of assessing tender responses. Manufacturers have already started to integrate EBU LIST analysis into their own products, which also helps to improve compliance with industry standards. An SDK (software development kit) is freely available via GitHub.

For those who don't want to dig into the code, a fully web-based version is available at list.ebu.io. A test account can be accessed using the word demo as both username and password.

Setting realistic targets to improve the gender balance of our event programmes

The under-representation of women working in the field of media technology will not be solved overnight. The EBU T&I Department is committed to playing its part, writes **Françoise Davies**.

When I was a young girl in school, I remember being taught about the need to push for what were termed "equal opportunities". Today, a bit more than three decades later, equal opportunities are encapsulated within the broader area of *diversity and inclusion*. When you realize how much is still to be done, you can either find it depressing and stay in negative, non-action mode or you can push forward and play your part in making fair representation the norm rather than an exception.

In the EBU Technology & Innovation (T&I) Department, we recognize that championing diversity and inclusion is particularly challenging owing to the continued low representation of women in engineering and technology. To address this, our first step has been to acknowledge it (not always easy in itself), and the second has been to establish several action points to combat this under-representation.

STEM FOR GIRLS

We know that you cannot fix gender inequality overnight. There is no quick fix. Indeed, if you think *only* in terms of an annual KPI you may as well stop. To increase the number of female engineers we must go back to grassroots and encourage young girls to contemplate STEM (science, technology, engineering and mathematics) subjects when making their choices for secondary school, and then have these same young women consider continuing with a career in the sciences. It's about creating internships and links with universities. It's about making women comfortable with raising their profile and, for example, taking that first step of speaking in public to a room of peers. It's about mentoring, and having networks to share and exchange as well as to support and advise. All of this takes time.

Earlier this year the EBU joined *50:50 The Equality Project*, a BBC initiative* that has now also been picked up by at least 13 EBU Members along with a range of NGOs, universities and commercial companies. The 50:50 project aims to rebalance representation in the media in a quantifiable and methodological way.

A key aspect of the 50:50 challenge is collecting data to drive change without compromising on quality. To do this we are putting T&I's flagship events – our annual technology seminars, summits and workshops, as well as the Technical Assembly – under the microscope. Our goal is to reach 25% female participation as speakers, panellists or moderators. It's not 50:50 but it is a realistic goal. (Looking at our events in the past year, the average level for female participation was 17%.)

If you are a woman working in the media as an engineer, developer or technologist of any kind, and are interested in contributing to one of our events, please get in touch. You can start with an email to Françoise Davies (daviesf@ebu.ch).

EVENT PROGRAMMES

With this goal in mind, the whole T&I team is proactively working to have more women contributing to our events. We are also encouraging EBU Members to identify and encourage women on their technology teams to take that step to publicly raise their profile, alongside participation in our various working groups.

Our calendar of events for the next year has already kicked off with the Media Cybersecurity Seminar. When the last event on the 2021–2022 list takes place, the Network Technology Seminar next June, we will be able to report on how we're doing with the challenge.

By working with colleagues – *all colleagues* – as well as our Members and partner organizations we aim to increase awareness and encourage women in media technology to be proud and visible. Leaving aside the documented business advantages of having a diverse and inclusive workforce, it is morally right, and we can only do this if we work together. Will it be easy? No. But that is why it's a challenge.

*bbc.co.uk/5050

Diversity, Equality & Inclusion (DEI) at the EBU

The effort to improve the gender balance at T&I events is just one part of the EBU DEI Strategic Initiative. It seeks to inspire and support Members' efforts to reflect the evolving societies they serve, in their content and workforce. The initiative encompasses a range of strategies including sharing knowledge and best practices, conducting research and analysis, and fostering DEI values through advocacy and promotion at EU and international levels. For more information, contact the DEI Officer, Francesca Scott (scott@ebu.ch).

Producing more content while reducing carbon emissions in a time of shortage

The adoption of new technologies usually comes with an environmental cost, but there can be positive outcomes for sustainability too, writes **Cédric Lejeune** (Workflowers).

Though sustainability is often linked to climate change, it also relates to other topics, such as the availability of technical resources. We already know today that we can't get all the graphics cards we need, and it's not only because of crypto miners: it's also because Taiwan faces a drought and producing chipsets requires a lot of water.

Car manufacturers are halting their production lines, and my friend who shoots documentaries cannot buy a second camera because the model she needs is not available anymore.

Cooling towers at a datacentre

WaitForLight/Shutterstock.com

TRANSFORMING SUSTAINABLY

The media industry is right in the middle of its second digital transformation: AI, cloud workflows, LED walls for virtual sets. These new technologies use a lot of technical resources – advanced electronics, complex alloys – and despite "digital" becoming ubiquitous, we still use a lot of industry-specific equipment. The move to IP infrastructure already allows us to get rid of a lot of SDI equipment and replace it with commercial off-the-shelf IT devices, though sometimes using them in a very different way to most other industries. Nevertheless, ultimately other industries use more and more video so we may see convergence in the architectures offered by cloud providers.

To reduce emissions and power consumption some providers are installing datacentres in cold countries such as Sweden, where they require less cooling. This is significant because traditional refrigerants can have a terrible greenhouse effect, up to more than 2,000 times that of CO_2.

Another approach can be water-cooling, and Microsoft has taken the concept to the limit by creating an underwater datacentre, a strategy that could reduce waste heat, which will be more and more regulated.

SMART USE OF AI

Lately at Workflowers, we have been testing the use of AI to reduce the rendering time of animation content when creating higher resolutions, rendering 720p from the 3D rendering engine and upscaling that to output 1080p or UHD. While the first results are promising, it also shows that there's a lot of progress to be made. AI and machine learning take a lot of computing, but they can have a significantly positive impact when used to reduce computing requirements somewhere else. Video compression is a very interesting field of research for AI (see https://mpai.community/), as distribution of more content to different formats requires massive infrastructure. A better understanding of the content before it gets encoded should help the reduction of data rates.

At some point we may also question producing and distributing 4K or even 8K content when TV manufacturers are differentiating themselves on the AI processors they integrate in their sets (although chipset shortages will have an impact on that industry too).

Producing in full resolution and/or HDR could be reserved for premium content, avoiding the need to replace a lot of gear and instead keeping it for a longer time, which is also a great way to optimize emissions.

Our business uses a lot of resources. We may find solutions that have a positive environmental impact, by reducing the need for transportation of people and data, but ultimately that will only have a relative impact on the emissions per hour of content. If we're looking at the absolute values, the only way to reach our targets for carbon emissions is to change significantly the way we produce and consume content. That leaves a lot of room for innovation, of the disruptive kind, because going +1 or x2 with typical incremental innovation is certainly not sustainable, and very soon we will see the model break. But it the end, is that really a bad thing?

Keeping humans at the heart of our technological evolution

At Belgium's RTBF, the Technology Department is a driving force behind the ongoing digital transformation. Beyond technologies, however, lies the human challenge, and it will remain at the heart of the evolution, writes CTO **Cécile Gonfroid**.

Our tools are changing, our behaviour is changing, our relationship with time is changing. New realities emerge and become more and more important: digital transformation, artificial intelligence, big data, remote working, cybersecurity; these terms and concepts are now the backdrop of our daily lives, but they only make sense if people are at the centre.

New technologies allow us to do our jobs with ever greater efficiency, using more and more interconnected tools that adapt to each user's needs. Their impact on RTBF's men and women is significant and positive: streamlining and automating our processes enables us to capitalize on high value-added activities. This makes everyone's job easier and more rewarding.

Sitting in the driver's seat of evolution, co-creating with the business, and being an operator of trust will remain my ambitions for the coming years. To put this another way, our future priorities can be listed as follows:

1. Being an early follower and data-driven
2. All IP and fully software-based
3. Security by design
4. HDR and 4K from end to end
5. Versatile workplace
6. Mobility first: wireless and with maximum interconnectivity
7. Unified and centralized post-production system
8. Secure, cloud-oriented base infrastructure
9. Total experience (TX) for users and audience
10. Self-service and hyper-automatization

NEW RTBF HQ

I want to mention two projects in particular that show where we are headed. The first is our new headquarters in Brussels. We will move into RTBF's Media Square in late 2024. The facility will embrace modern, robust, efficient and scalable tools, based on up-to-date and standardized technologies.

Our guiding principles for this project include the early adoption of innovative technologies, and using high-performance tools that really fit our needs, ensuring both quality and compliance with universal standards. Collaborative tools, where users are involved in the selection process, will ensure that teleworking and mobility are prioritized. Internal communication and knowledge-sharing are critical, as are training and support to ensure mastery of the tools.

Cécile Gonfroid, Chief Technology Officer of RTBF

Media Square will be designed to allow production of more content on all platforms in an agile and efficient way, by a true 360° approach from acquisition to publishing (via post-production and distribution). Technological specificities by brand or medium will be limited, to ensure simplification.

CONTROL ROOM 42

Another project that encapsulates our technology vision is Control Room 42, an experimental broadcast production control system based on IT, IP and software technologies. It is designed to reinvent the way we create live content.

The objective of this proof of concept is to evaluate and challenge new ideas in a real live production environment. Fully software-based, Control Room 42 gives the opportunity to test ideas and concepts in a period of just a few hours. This allows a quick design process with our production partners. Hardware and function-specific tools disappear and are replaced by a touchscreen interface, reshapable for each position, allowing a flexible usage of each workspace.

While dedicated production tools and their specific ergonomics have, for decades, shaped our ways of production, supporting and integrating, Control Room 42 represents tomorrow's versatile workspace. Virtualizing the tools with a common interface represents a disruptive transformation for unprecedented flexibility in all productions.

This digitalization deeply changes methods and expertise: it is a major technological and human challenge.

Building the next phase of the global 5G infrastructure

With "5G Advanced", 3GPP takes its next step in developing standards for the global 5G system. The organization's December 2021 group meetings will focus on the content of 3GPP Release 18, the first within this next phase, writes **Georg Mayer**.

Over the last 5 to 10 years, 3GPP has seen growing participation from companies and organizations with a non-telecommunication background. These entities from other industry sectors are usually summed up under the term "verticals" and they range from businesses related to emergency first responders, self-driving cars, satellite vendors, factory builders, agriculture, hospital and medical services and, neither last nor least, broadcasting and media organizations. One basic common interest among these diverse vertical players is the wish to make use of the global 5G network as an enabler for their services.

REQUIREMENTS & CONSTRAINTS

Recent 3GPP releases created a baseline of standards for 5G, triggering the roll-out in many global markets of products and services meeting both consumer and industry needs. This success in a short time and on a large scale is only possible because 3GPP is open to new requirements with every new release, but also sets a number of constraints before initial ideas can make it into an approved 3GPP specification.

With *5G Advanced*, 3GPP will further develop and enhance these existing services, but will also include new technologies and services in the 5G platform. First candidate topics are AI and machine learning, highly sophisticated internet-of-things scenarios, and capabilities for extended reality, i.e., creating a truly immersive virtual reality experience for applications and media that have strong interactions with the real world.

Georg Mayer (Huawei), chair of the 3GPP technical specification group on Service and System Aspects (TSG-SA)

Broadcasters have been participating in 3GPP for several years already and were especially active during Release 17 in several work items. Two of those work items were 5G Multicast Broadcast Services (5MBS) and ProSe (also known as Sidelink) for proximity services. When 3GPP discussed the detailed objectives of these work items two years ago, they got huge support from many different companies across various industries. Both were co-signed by over 30 companies from all regions of the globe.

However, in order to get Release 17 completed on time, nearly all items, including 5MBS and ProSe, had to be reduced from their initially intended scope. This meant that some features had to be left out which were important not only for broadcasters, but also for other companies. This didn't mean that the parts that were left out would never be realized by 3GPP; rather it illustrated the functioning of the *release* mechanism. New services start from a small and basic set of objectives, on which all interested parties can agree, i.e., consensus for the way forward is approved.

CONSENSUS IS KEY

As strange as it might seem, the principle of seeking consensus is a mechanism that is working very well in 3GPP. It is a key signal to all product developers that what is written in 3GPP standards has broad support and therefore is ready to be released to the market.

Now, at the outset of Release 18, both 5MBS and ProSe are again on the candidate list, this time with many new enhancements and ideas that all build on what has been achieved in the previous release. Once again, most likely not everything will make it through the upcoming discussions about the content of Release 18, but consensus will be reached on what will be 'in'. Beyond that, there are a host of other interesting and powerful new features that will be of potential benefit to broadcasters.

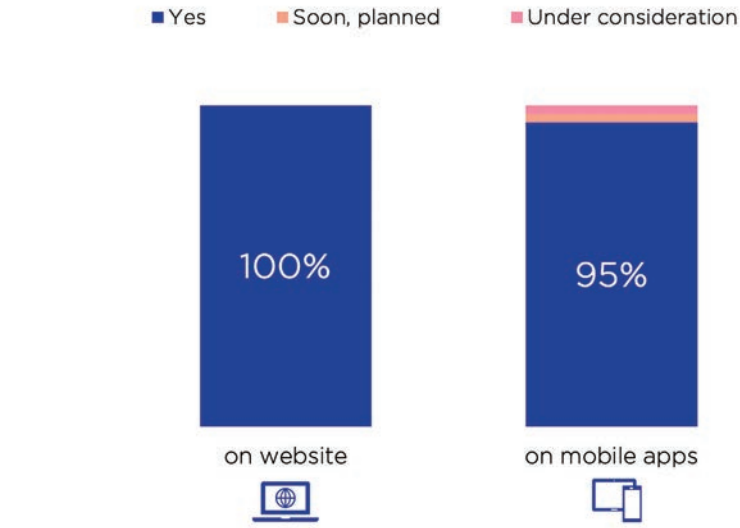
All of this shows that engagement in 3GPP – or more generally in standards – needs to be considered long-term. Participating in standards is essential for all companies that want to make use of the related services, as they can participate in the shaping of future technologies and also learn from others what capabilities the 5G system really offers.

PSM distribution strategies for audio-on-demand content

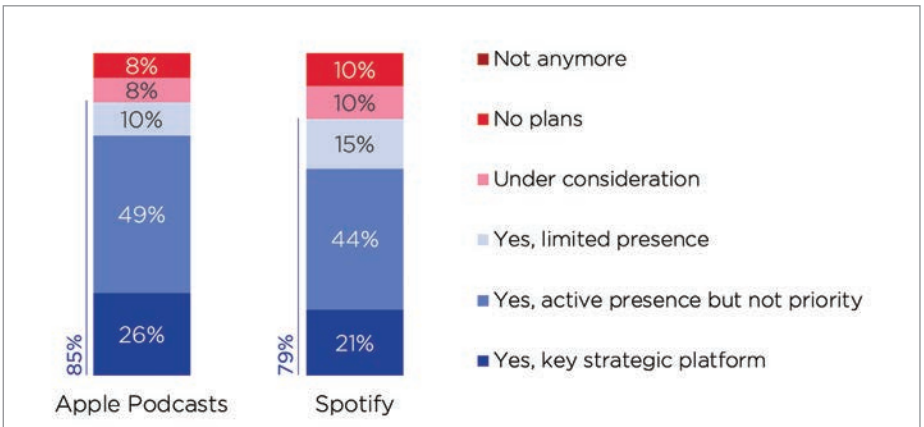
EBU Members have been revamping their audio platforms to adapt to changing usage patterns. **Léa Besson** (EBU Media Intelligence Service) shares some insights from a newly published report on the topic.

Public service media (PSM) companies are trying to find the best model for their own market following significant changes in audio consumption patterns, accelerated by the pandemic. In 2021, at least five EBU Members decided to reimagine their audio platform. This ranged from revamping the 'look and feel', such as Spain's RTVE moving away from *A la carta* to introduce *RTVE Play Radio*, to separating audio from video, as done by Switzerland's RTS in removing its audio content from the *Play RTS* website, or conducting a full makeover, taking the example of Italy's Rai that will soon launch *Rai Play Sound* to replace *Rai Play Radio*.

Beyond those changes, PSM audio services remain quite fragmented as many organizations report having several platforms and sometimes even one website per station. Nevertheless, it now seems that mobile is where they want to focus their efforts in order to follow nomadic and screen-free audio consumption trends: 95% of the PSM audio online offer is available via mobile apps – and soon even more.



Availability of PSM online audio platforms, as % of radio Members with an online offer (Source: EBU based on Members' data, including 38–39 radio Members)



Members' presence on third-party audio platforms, as % of radio Members (Source: EBU based on Members' data, including 39 radio Members)

PROPRIETARY VS. THIRD-PARTY

While EBU Members put massive efforts into their own platforms, PSM audio content is also often present on third-party audio streaming platforms. Eighty-five percent of Members have content on Apple Podcasts, with Spotify catching up. Nevertheless, while a large majority of PSM organizations acknowledge they are present on Apple Podcasts and Spotify with their podcasts, very few consider those platforms to be strategic. Indeed, distribution strategies for content are under review and for some PSM, their proprietary platform is clearly the priority.

More proactively, half of PSM provide some audio content – mainly news – on smart speakers. Of those Members that have a smart-speaker offer, 89% provide news content. Where this is the case, half of them negotiated to be the default news provider in the country, which is a good sign of trust in PSM news.

***These insights are drawn from the recently published EBU Media Intelligence Service and Media department report* PSM Audio On-Demand Landscape. *See:* ebu.ch/publications/research**

IN THE SPOTLIGHT

Jan Devos

ENTERPRISE ARCHITECT – VIDEO, VRT

WHAT ARE YOUR CURRENT RESPONSIBILITIES?
As an architect I have two jobs; to communicate and set context, and to make marginal decisions on technology architecture. Communication is about ensuring management understands the opportunities and risks technological evolutions bring, and about talking to project managers and domain experts to give them wider context of how their activities fit into the larger enterprise environment. Technology and thus the overall architecture evolves so quickly that it is not possible to attain an ideal state; instead, I rely on a vision that is more abstract and make decisions at the margin to move the needle in the right direction one step at a time. The best decisions are those that only add complexity by reducing it somewhere else and are reversible with minimal sunk cost.

WHAT DO YOU CONSIDER AS YOUR FINEST ACHIEVEMENT SO FAR IN YOUR CAREER?
My domain of expertise is digital video publication and distribution. In 2013 I started at VRT as a video expert, and through the years I was able to rebuild and evolve the digital distribution pipeline starting with video encoding, and then later streaming distribution, and finally automated and centralized publication of media assets. I'm very proud that, through evolutionary architecture methods, the system that was small in scale to begin with has grown and improved over the years to now serve millions of users every month.

WHAT ARE YOUR PREDICTIONS FOR MEDIA TECHNOLOGY IN THE FUTURE?
A key capability for technology departments in the coming years will be to design user interfaces on top of the production and publication systems. While production teams are being organized around content rather than publication medium, the technological tooling is still very much heterogeneous. At the same time, the digital native generation is used to and expects self-managed platforms such as YouTube, where a content creator can manage their own publication channel. Technology departments will have to respond by developing self-servicing user interfaces for content producers that tie multiple production and publication systems together.

Jan Devos chairs the EBU's Broadband Distribution Architectures project group

Kurt Beyers

WHAT, FOR YOU, ARE THE BIGGEST CHALLENGES FOR EBU MEMBERS TODAY?
The competition for eyeballs with social networks and global streaming players is the key challenge. Fragmentation in the local market only drives (young) people away to consolidated offerings such as on YouTube or Netflix. On top of that, building your own digital distribution infrastructure that is equivalent in qualitative experience to the big players is very difficult. It makes sense for broadcasters to work together on infrastructure and joint offerings, and differentiate on content only.

TELL US ABOUT SOME OF YOUR INTERESTS AWAY FROM THE WORKPLACE.
I'm a big hiking fan, particularly in the mountains. Last year my wife, six-month-old daughter and myself ventured into the Swiss Alps for a campervan trip with some hiking. It was challenging with a young child, but spectacular and rewarding as well. Besides that, I also enjoy reading. I recently finished Kafka's collected works; I'm a big fan of his absurd reality and how he portrays it as if it is a normal description of everyday life. I also started re-reading the Foundation trilogy by Isaac Asimov because of the release of the television series. The way that he approaches the story by jumping between different decades and describing the struggles of the different generations to deal with the "crises" is very well done.

EBU

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