

tech-i

T&I Award 2023: BBC's crowning achievement with 5G

Plus

- Decision time on the UHF band in Europe
- Pedalling towards more sustainable production
- NPO's Willem Roskam on the changing role of technology in the boardroom

and more...

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Cover story: The EBU Technology & Innovation Award 2023 went to BBC for taking the use of private 5G networks for contribution to the next level. While previous tests had involved smaller networks, the coronation of King Charles III in London offered the opportunity to test the new approach at scale. Our cover shows the project leader Ian Wagdin installing one of the 5G cells. Read the full story on pages 10-11.

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Mastering technology to better serve audiences

Antonio Arcidiacono, Director of Technology & Innovation, EBU

For most of the history of electronic media, there was a clear separation between technology and content, between the engineers and the people who make the television and radio shows. Those boundaries have now blurred or even entirely disappeared in many cases. This change happened gradually with the development of innovative apps, platforms and digital tools that give editorial staff and creatives the power to do things that previously required direct support from technology and engineering teams. Indeed, even audience members can today quite easily produce high-quality content using devices and tools available to everyone.

At the same time, the democratization of media technology tools and the rapid evolution of AI technologies are opening many new opportunities for the technology departments of EBU Members. My vision is to develop together a new media space that leverages AI technologies and resilient IP and cloud-based networks, from production to distribution, applying automation wherever possible. In this media landscape, where technology is ubiquitous and changes are increasingly driven by the global tech companies, the EBU Technology & Innovation (T&I) department creates a collaborative environment to empower media engineers, drive industry standards, develop reference designs, and propel the media sector into the future.

As the technology community of public service media (PSM), this is our *raison d'être*: we must continue to collaborate, combining our resources to work and build together. With technology now woven into every action and interaction, it is ever more urgent that we have the



means to master technology as a key enabler to increase value for audiences.

ASSEMBLING IN AUSTRIA

Our Technical Assembly brought technology leaders from 41 EBU Members together in Austria last June – kindly hosted by ORF – to discuss technical challenges facing PSM. While the situation differs from country to country, there are common goals: to transform operations, develop digital platforms, reduce costs, and enhance the quality, prominence and engagement of PSM with all audiences.

EBU T&I, collaborating closely with the Technical Committee and its working groups, is striving to support Members in addressing these challenges and transitions across the full media value chain, from planning and creation to publishing, distribution and audience engagement.

In response to recent crises, Members are focusing on resilience and business continuity strategies. They are developing integrated digital organizations that combine various platforms, such as linear, online, in-car, and satellite, and involve audiences in a continuous dialogue through

both human and AI-driven interactions. To support these endeavours, EBU T&I is aiming to accelerate media automation and content creation and exchange through the development, integration and management of new instruments.

We are also continuing our work on using AI technologies to increase efficiency, automation and speed. Our suite of products and services includes EuroVOX for translation and transcription, along with PEACH for personalization and recommendation; we are also leveraging the News Pilot experience, exploring the combination of EBU Members' content with generative AI technologies, or the use of AI to extract metadata from Members' archives.

STRATEGIC ROADMAP

The new Technical Committee Strategic Roadmap (available at tech.ebu.ch/publications) details the work foreseen in the next two years. This roadmap, along with the suite of products described above, encapsulates the concrete value proposition brought by EBU T&I to EBU Members.

The Strategy Roadmap includes a framework for guiding activities that shows PSM values and business priorities at the core of all operational and transformative activities, and end-user touchpoints with the audience as the ultimate delivery point for added value generated by an EBU Member. Technology is the essential glue that connects a PSM organization's goals, its value chain, and its users.

By replacing the previous workplans with this new Strategy Roadmap, we will be better able to support technology teams at EBU Members as they, in turn, underpin the transformation of their own organizations.

How STADIEM has accelerated media innovation in Europe

The EU-Funded STADIEM project – running since 2020 and soon to reach its end – broke new ground by creating an acceleration platform for European media innovation. Through two open calls, the project attracted over 570 startups, from 26 different European countries and beyond, 80 of which were selected to take part in the programme. It culminated in 10 pilots conducted with prominent corporate partners from the extensive STADIEM hubs network.

Both pilot rounds featured outstanding solutions in a variety of media-related fields, from monetization and data to content creation and distribution. The innovations and corporate partners involved in STADIEM's first cohort of pilots included: FilmChain, a platform for revenue collection and payment in the film production sector, working with Alamode Filmdistribution; the omnichannel story content creation tool Zazu, teaming up with Roularta Media Group; Tinkerlist.tv, collaborating with VRT and DPG Media on remote



Left to right: Wim Vanobberghen (VRT and STADIEM Project Coordinator), Leshia Shaldenko (Wantent), Marianne Fjellhaug (Media City Bergen), Niamh Faller (Druid Learning), Peter De Paepe (VRT Sandbox) and Sophia Boysen (BotTalk)

production; and Trensition, providing trend analytics to Roularta Media Group and SWR.

The most recent pilot round featured: Druid Learning, a white-label educational content e-commerce platform teaming up with Irish educational publisher CJ Fallon; Scriptix, a speech-to-text service provider focused on smaller languages such as Flemish and Belgian French, for Roularta; Limecraft, working with VRT on automated subtitling; einbliqu.io's streaming analytics, supporting rbb and

ARTE; BotTalk, piloting custom artificial voices with Funke, NOZ, t-online, VRT, Mediafin and Roularta; and Television. AI's multi-tool services (footage analysis and automated video production services, such as editing and voiceover), put at the service of rbb.

See these innovative media solutions in action with STADIEM at IBC2023 in Amsterdam on 15-18 September. For details, visit: stadiem.eu



Recognizing young tech talent

The prize-giving ceremony for the EBU Technology & Innovation Awards 2023 took place in Vienna in June during the 29th Technical Assembly. The overall award went to BBC for their pioneering use of private 5G networks for contribution. You can read more about that project on pages 10-11, with the runner-up projects featured on pages 7-9.

The Young Technology Talent Award went to Jaime Sánchez Roldán (pictured) from the Universitat Politècnica de València, in recognition of his work on the development of an 'Open Source LTE-based 5G Broadcast Platform'. In developing this platform, Jaime has contributed significantly to the advance of 5G Broadcast technology in Spain and beyond. The platform is also notable for the new algorithms used and features included that improve performance.

The project was undertaken in conjunction with the 5G-MAG association, which is encouraging the development and use of 5G systems for media use cases.



MaryKos Photography

Boosting engagement at EBU T&I events

Last May's Network Technology Seminar was the first EBU Technology & Innovation event to test the unconference format. The experiment was well received by participants, who took to the new format – applied on day two of the event – with enthusiasm. It will be used selectively for future EBU T&I events, starting with the **Media Cybersecurity Seminar 2023 (11-12 October)** and **Horizons 2023 (14-15 November)**, the latter with a focus on media distribution and platform technology. Both will couple one traditional conference day with one unconference day.

How did it work in practice? While the first day of the Network Technology Seminar offered the usual mix of keynotes, technology updates and case studies, the second day saw participants co-creating an agenda that packed in 20 sessions on a broad range of topics. Allowing any attendee to pitch a session and add it to the agenda meant that the topics that were of most immediate interest and importance to them came to the surface.

Building the agenda took 20-30 minutes, after which the sessions ran in parallel throughout the day, hosted and

The unconference format will be used again for the Media Cybersecurity Seminar and Horizons 2023.

facilitated by the people who pitched the sessions, often with assistance from others in the room. Participants rotated to the relevant room each hour to join their chosen session. A short report was filed for each session and the session hosts provided an oral summary during the closing circle that rounded off the day. In each case, hosts were asked to highlight any next steps that would or should be taken for the topic in question.

With the COVID-19 pandemic having boosted online events, the return to physical events has demanded the addition of greater value for those who travel. By offering unconferences, EBU T&I aims to give participants more engagement, more discussion and ultimately more value to take back to their company.

Updated guidance on UHD/HDR content exchange

The EBU Exchange Parameters for UHD/HDR* programmes – both live and file-based – have been updated by the UHDTV strategy group, under the leadership of Karl Petermichl (ORF). Based on recent work from contributing EBU Members, the new versions are designed to be easier to use.

The updated recommendations are to facilitate content exchange between EBU Members, other broadcasters, service providers and production companies. The guidance is meant as a 'safe starting point', for use when no other agreements between two parties for UHDTV programme exchange are in place.

The main changes for the live recommendation (EBU R 153) include a reference to the single-master HDR production workflow, the use of eight audio channels for channel-based audio production, and reference to EBU-TT/IMSC instead of EBU STL where subtitling is provided.

The file-based exchange parameters (EBU R 154) now recommend the use of XAVC MXF (or IMF where multiple versions are required), and the use of EBU-TT-D for any subtitling. Readability of the audio section has been improved by clearly outlining two options: conventional audio and metadata-guided audio.

* High dynamic range



Karl Petermichl (ORF), chair of the EBU UHDTV Strategy Support group

Finding the right motion-capture tool for the job

The EBU's Computer-Generated Animation group, writes co-chair **Roberto Iacoviello** (Rai), aims to help Members better understand what this technology can do for them and how to choose the most appropriate tools.

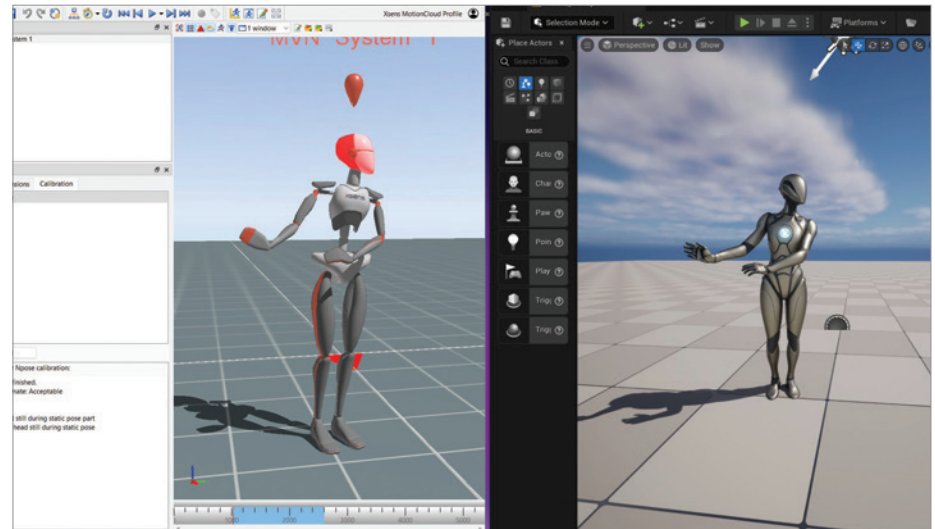
Virtual production has revolutionized the way movies, television shows and other forms of media are created. It enables filmmakers to visualize and manipulate virtual environments, characters, and special effects in real time, reducing the need for extensive post-production work. By integrating live-action footage seamlessly with CGI (computer-generated imagery), virtual production, capturing quality and realism of the final product. It offers a cost-effective and sustainable alternative to traditional production methods.

Real-time motion capture is a crucial component of virtual production. It involves capturing the movements of actors or performers and translating them into digital data that can be applied to virtual characters or objects.

In the EBU's CG Animation group, we have explored the significance of motion capture in the broadcaster pipeline and its vital role in enhancing the virtual production process. This technology enables the creation of realistic and dynamic performances, as the digital characters mimic the movements of the actors in real time. More recently, motion-capture systems have become sensitive enough to capture subtle details in the face and fingers, giving rise to performance capture.

Discussions in the CG Animation group have focused on the importance of understanding use cases and requirements, the difficulty of comparing various motion-capture tools, and proposing a methodology to facilitate the comparison process.

The group has produced a document on use cases and requirements. Each project or



The EBU CG Animation group is developing a methodology for comparing motion-capture tools

production has its unique needs, and identifying them beforehand helps streamline the tool-selection process. By defining the specific goals, desired outcomes, and technical specifications, we were able to narrow down the list of potential solutions, making the comparison task more manageable.

COMPARING THE TOOLS

The vast array of options often leads to confusion and difficulty in comparing them effectively. Factors such as the tracking accuracy, ease of use, compatibility with existing workflows, and post-processing capabilities must be considered. Additionally, understanding the level of support, training, and ongoing maintenance provided by the tool's developers is crucial.

To simplify the comparison process, it is beneficial to develop a methodology that focuses on key evaluation criteria. Currently we are working on a methodology that includes factors such as tracking accuracy, compatibility with industry-standard software,

ease of integration, scalability, and cost-effectiveness. By establishing a comprehensive evaluation framework, we will objectively assess each tool's strengths and weaknesses, facilitating an informed decision-making process.

To gain a deeper understanding of the significance of motion capture in the broadcaster pipeline, we are currently conducting a survey among industry professionals. This survey should aim to uncover the perceived importance of motion-capture technology, the benefits it brings to content creation, and the challenges faced by broadcasters in integrating it into their workflows. By gathering feedback from a diverse range of experts, the survey results can shed light on current practices, trends, and areas for improvement within the broadcaster pipeline.

To follow or get involved with the CG Animation group's work, EBU Members should visit:
tech.ebu.ch/groups/CG_animation

Combining 5G Broadcast and broadband in one application

Michael Wagenhofer, CEO of ORS Group, explains how the Austrian broadcasting service provider is changing the broadcasting landscape by merging two technologies for content delivery.

Live events such as soccer championships, Formula One races, or unexpected disasters pose a major challenge regarding planning the live content distribution via content delivery networks (CDNs). This is a problem every broadcaster is facing. They not only have to plan for the potential peak load, typically unknown in advance, but also for the total consumption during the live event. Both values, which come with high uncertainty, must be budgeted in advance technologically as well as monetarily.

Since we have been providing our terrestrial and satellite services to the industry for almost 20 years, we asked ourselves whether we could solve this problem with a broadcast technology. The emergence of 5G Broadcast did indeed enable us to develop an innovative way to offload this traffic and solve the planning and cost uncertainty. 5G Broadcast provides a way of using the existing headend for CDN distribution to broadcast live streams via IP over the air and enables the use of the existing digital terrestrial television (DTT) infrastructure.

MERGING TECHNOLOGIES

With Nakolos, a joint project of ORS Group and Bitstem GmbH, we are utilizing these advantages, offering a system that converges two technologies, 5G Broadcast and broadband. In case many users request the same content from a CDN at the same time, for example during a live event, the channel is automatically set up and transmitted via 5G Broadcast. The Nakolos solution is easily integrated into existing



(Left to right) Harald Kräuter (CTO, ORF), Florian Tursky (Austrian state secretary for digitization and telecommunications), Michael Wagenhofer (CEO, ORS Group) at the Nakolos booth at Mobile World Congress 2023.

broadcasting apps and enables seamless switching between 5G Broadcast and broadband by synchronizing the CDN and DTT reception on the device without the user noticing. This mechanism allows the broadcaster to offload CDN traffic and therefore reduce its CDN costs.

An additional benefit of 5G Broadcast is that it reduces the mobile data consumption of the user since the reception of 5G Broadcast is free-to-air and does not use the data included in the mobile data plan.

The Nakolos project aims to support 5G Broadcast as an innovative broadcast technology in the UHF spectrum. By promoting the adoption and utilization of 5G Broadcast, we reinforce the significance of DTT and its role in the broadcasting ecosystem.

SHAPING THE ECOSYSTEM

We are not only addressing broadcasters and content providers, but also provide developers, such as the 5G-MAG

Reference Tools community, with resources, demos and an open test environment for free trials and demonstrations. This comprehensive approach aims to help all stakeholders in the 5G Broadcast ecosystem to maximize their potential and achieve their goals.

Nakolos presents a breakthrough in the advancement of broadcasting technologies, making streaming content to a large number of people more efficient by enabling the convergence of 5G Broadcast and broadband. With Nakolos leading the way, broadcast technology continues to advance, empowering stakeholders and shaping the future of content distribution.

If you would like to partner with us on a testbed or for further information about Nakolos visit nakolos.com.

The Nakolos project was a runner-up in the EBU Technology & Innovation Award 2023.

Solving the lighting challenge in self-driven studios

Christoph Flüeler, a system and software engineer at Swiss public broadcaster SRF, introduces a breakthrough approach to studio lighting, the Self-directed Lighting System, SLS.

SLS is a lighting automation system, based on object tracking, that provides lighting optimized for broadcast/video purposes dynamically and in real time. Depending on the position of the camera and target people, lighting tasks (typically what are known as the highlight, the guide light and the fill light) are distributed among the available light sources (moving lights) so that the targets are optimally illuminated.

Building a new studio for news and sports, the aim was to achieve a very high degree of automation and thus a reduction in required staff. Nevertheless, with special news programmes and roundtable discussions with studio guests, unplanned movements cannot be excluded. Such scenarios, however, would require lighting staff, which could not have been arranged at short notice, especially for breaking news.

The lead of the SRF lighting team therefore suggested a proof-of-concept for a self-propelled lighting system that would enable professional lighting in the broadcast area without staff supervision. The basic idea was to track all people and objects (cameras) relevant for lighting and to calculate optimal lighting based on their position.

DIFFERENT SCENARIOS

At the moment, three possible scenarios are available:

- One person, one camera: the lighting follows the camera-target axis, and the axis is shifted when the target or the camera (or both) moves. Light direction, angle, focus and intensity is dynamically adjusted. If there are multiple cameras, the axis is switched according to the camera that



Configuration is done on-site using an iPad app that communicates with a cloud-based service

is currently on air. The lighting director defines for each target person individually how they are to be illuminated, deciding with which intensity, from which directions (related to the camera axis), and with which focus an object/person is to be illuminated.

- Several people: if the people are separated by some distance, they are detected as individual lighting targets; if they are in groups, parameters can be set for large-area lighting.
- 'Fences' with presets: any area of the studio space can be configured for a specific behaviour of the lighting. Thus, a presenter at the desk can call up a preset individually optimized for hair and skin colour as well as body size. When they move outside this area, the lighting is switched to follower control; when they walk into the fence with guests, the lighting is extended and when they move towards the big screen, the lighting is optimized in relation to the

camera axis.

We are dealing with a paradigm shift here: the classic lighting approach is reversed. It is not the lighting director who decides which light should shine where (programming presets), but the position of the target dictates with which lamps an optimal result is achieved in relation to the camera.

As the trackers are individual, a specific set of situations can be configured for each person according to hair or skin colour, size or gender.

From the very beginning, one of the declared aims of SLS was not to replace experienced lighting staff, but to improve/upgrade the lighting in situations where, for operational or financial reasons, no lighting staff can be arranged. The entire development was supported and driven by the lighting team at SRF - a good example of interdisciplinary cooperation.

This project was a runner-up in the EBU Technology & Innovation Award 2023.

Using 5G to create synergies across the entire media chain

Mauro D’Onofrio, Head of Innovation & Research at Rai Way, describes how the Italian operator tested the integration of 5G Broadcast and broadband technologies for media use cases.

Our project, born from a programme funded by the Italian public administration (MIMIT), had the objective of testing innovative audiovisual content production and distribution using 5G Broadcast and broadband technology.

In the field of content distribution, the combination of 5G Broadcast and CDN (content delivery network) technologies was tested to optimize linear broadcast and broadband content distribution. A 5G Broadcast network covering the cities of Turin and Palermo with a 5 MHz channel in the 700 MHz SDL (supplementary downlink) band was realized, fed by a CDN delivering the same content as the broadcast network. A 5G Broadcast SDR (software-defined radio) prototype receiver was developed, implementing seamless switching between broadcast and broadband delivery to maximize the performance of the combined network, switching to the good one in case of a fault or S/N (signal to noise) degradation of the other, and offering an optimal user experience.

LIVE VR360°

In Palermo’s Massimo Theatre, live 360° virtual reality signals were produced and transmitted to Rome to be fed into a CDN and a 5G Broadcast core network, to be finally distributed via 5G Broadcast in Palermo. The 5G Broadcast VR360° signal was received by a fixed UHF antenna and an SDR prototype receiver, to be finally retransmitted via Wi-Fi 6 to VR headsets with a high QoE (quality of experience). Reception was demonstrated both in a conference room at the Massimo Theatre, where invited participants were present, and at a Palermo school, *Convitto*



Nazionale Falcone, where many students were present with their professors. A similar use case was realized at the Modern Art Gallery in Turin.

LIVE AUTOMOTIVE

For the automotive use case, the prototype receiver was integrated in the infotainment system of Kinocar, a highly connected minicar, to allow car-mounted vehicular reception, driving with a good QoE along the streets of Palermo and Turin.

The multimedia live content of the Italian broadcasters Rai, Antenna Sicilia and RETESETTE were used to feed the 5G Broadcast and broadband networks to reach the vehicle infotainment system and, via Wi-Fi, mobile commercial devices used by the passenger (smartphones and tablets).

5G JAZZ JAM SESSION

In the field of content production, the project exploited 5G private network technology to support distributed and remote television production of live events. The main objective was to reduce the latency of a private 5G network and audio/video digital encoding systems (some tens of

milliseconds), so that a jazz band, with some components in distant places, could play a jam session together. At the same time, the network had to guarantee signals of adequate quality to the remote control room for live broadcasting on television channels.

In the context of the Torino Jazz Festival 2023, a jazz improvisation by a 16-person big band was shown, where the musicians, in addition to playing on stage, took turns in the different remote areas. Using the content generated from this live performance, we put in place different experiences: on smartphones and tablets, in the metaverse with headsets, and live for an audience enjoying the show.

We are pleased to have demonstrated the potential of the Rai Way’s high-power, high-tower network for delivering 5G Broadcast signals in collaboration with broadband networks, reaching high efficiency and high QoE for live events enjoyed by a large number of connected users. We have created synergies between innovative audiovisual production, contribution and distribution networks, implementing immersive and engaging live artistic content, even in teaching scenarios. We’re grateful to MIMIT for the opportunity to participate in the 5G Audiovisual 2022 tender, and to our project partners – especially Rai – that have enabled us to achieve such a fine result.

This project was a runner-up in the EBU Technology & Innovation Award 2023.



BBC's crowning achievement with private 5G networks for contribution

In May 2023, the world's media were focused on the coronation of King Charles III in London. For BBC R&D, it was a golden opportunity for the biggest test yet of using private 5G networks for contribution. **Ian Wagdin** describes how the project unfolded.



Left to right: Michael Nugent (ERT), chair of the Technical Committee, presented Ian Wagdin (BBC) with the 2023 EBU Technology & Innovation Award during the Technical Assembly in Austria in June, alongside EBU T&I Director Antonio Arcidiacono.

Over recent years, news crews have increasingly relied on mobile networks to get pictures from the heart of the action: they offer a great way to get to places that you just can't reach with a satellite truck or cables. This means that there is computer hardware and kit available to broadcast from anywhere you can get a mobile signal. While this is OK most of the time, at big events the large mobile networks can get saturated with data very quickly, as everyone tries to upload content to social media and journalists compete to send their pictures back to news channels.

For such events the mobile network operators can add capacity, but this is aimed at their customers and is generally spread over a wide area. This means that broadcasters cannot rely on this provision when they most need it; so they use other technologies to support their

output, leaving all the kit that supports news contribution unused.

BIGGER CHALLENGE

BBC News approached BBC Research & Development following our successful trial of 5G Non-Public Networks (NPNs) at the Commonwealth Games last year and asked if we could help solve this issue.

It was a big challenge: could we provide a private 5G network that was available for the days leading up to the event and during the coronation itself? The requirement was high uplink capacity, over a large area, which could be offered to news broadcasters from around the world. It led to the deployment of the largest temporary private 5G network yet.

Crowds outside Buckingham Palace for the coronation





German broadcaster ARD waiting to go live from the Mall



Members of the project team from BBC R&D and Neutral Wireless

While we had trialled and tested smaller scale networks previously, this had been to support only one or two cameras. This would be a much bigger challenge. We planned to support up to 30 devices, all streaming high data-rate video from any point along The Mall in central London. We partnered with Neutral Wireless, a specialist in 5G NPNs that we had worked with previously on our 5G Rural First project on Orkney.

One of the challenges of streaming lots of professional video is the need for a high-capacity uplink. Most public networks are designed for their subscribers to download content. The only way we could deploy a network to support

the amount of traffic was to use spectrum separate from the public networks and available for shared access. Working with Ofcom, the regulatory body in the UK, we were able to secure 80 MHz of radio capacity centred on 3855 MHz.

RELIABLE NETWORK

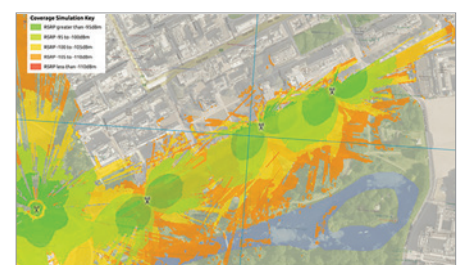
We deployed eight cells, all with very low transmit power but high receive capability. This provided reliable and constant coverage from Buckingham Palace to Admiralty Arch. Using mobile bonding devices such as LiveU's LU300 with 5G modems and dedicated SIM cards, we were able to move traffic away from the public networks and onto our private network.

This traffic was then backhauled over fibre to Broadcasting House where it met the internet, and from there to whichever broadcaster was connected. For operators and broadcasters the workflow was pretty much the same as they use every day, but we could be confident that their units would work no matter how busy the public network became. We had over 60 SIMs connected from multiple broadcasters from around the world.

Part of this work also involved Neutral Wireless building a dedicated user interface that enabled us to easily set up and monitor the network and provided special features applicable to the broadcast domain. We were able to identify how many cameras were on each cell and how the cells were performing. This in turn enabled us to identify which cell a particular device was on and whether they had the optimum connection for streaming live video.

5G FOR PRODUCTION

As part of this work we also wanted to see how we could use 5G networks for production. This requires high-capacity, low-latency networks that can deliver UHD HDR (high dynamic range) pictures with bidirectional control. Working alongside Sony, we had two cameras operating on a separate cell in front of Buckingham Palace. Here we also deployed DQoS (Dynamic Quality of Service), which prioritizes the active camera over others on the network. This has added to our understanding of how these networks may be used in the future.



Map simulating coverage from the 5G Non-Public Network.

Europe reaches decision time on the use of the 470–694 MHz band



Elena Puigrefagut, one of the EBU's experts on broadcast technology and spectrum, shares her personal views on the decisions that lie ahead both for EU Member States and the EBU itself ahead of WRC-23

While Europe seems divided on which position to take at the World Radiocommunication Conference in Dubai in November (WRC-23), the Radio Spectrum Policy Group (RSPG) of the European Union has prepared a draft opinion¹ on the use of the 470–694 MHz band beyond 2030. After an open consultation during the summer, the draft opinion is expected to be approved in October.

THE SCOPE

The 470–694 MHz band is the core band for digital terrestrial television (DTT) and audio PMSE (e.g., radio microphones). It is governed by the ITU Geneva 2006 Agreement (GE06). However, the extent to which the band is used by broadcasting services differs across countries.

At EU level, the band is made available to broadcasting services, including free television and audio PMSE, until at least 2030. This was a provision of the same EU Decision (2017/899) that harmonized the use of the 700 MHz band (694–790 MHz) for mobile services (5G mobile) across the EU after a common date (30 June 2020) and called on the European Commission

to review the use of the band. Although the Decision does not include a date for such a review, the so-called Lamy Report², which formed the basis of the Decision, points to 2025.

In advance of any regulatory decisions that WRC-23 may take and the EC review of the use of the band by 2025, the RSPG draft opinion analyses the flexibility in the existing regulation, discusses different future usage scenarios, and provides recommendations to Member States.

CURRENT FLEXIBILITY

The RSPG recognizes that the existing regulation already provides enough flexibility for the use of the band by services other than broadcasting, for example mobile services, in function of national needs. This flexibility is found:

- in the Decision (EU)2017/899, although any new use needs to respect the interference requirements of broadcasting services in neighbouring countries and cannot claim protection from them;
- in the GE06 Agreement via the envelope concept, which relies on the equivalence of spectral

power density to allow the use of a frequency assigned for DVB-T by another service of equivalent spectral power density. Declaration 42, signed by all EU Member States, extends the concept to any type of service irrespective of whether or not it has a primary status in the table of frequency allocations of the ITU.

This recognition of existing flexibility in current regulations is important because those countries supporting a co-primary allocation of the 470–694 MHz band to mobile services at WRC-23 claim 'flexibility' as one of the main arguments. Broadcasters have always said that the regulations are already sufficiently flexible and that co-primary allocation would not bring any additional flexibility. On the contrary, various studies and real cases have shown that broadcasting and mobile services cannot operate on the same frequencies in the same or adjacent areas without causing harmful interference to each other. The interference can be reduced by geographically separating the services with large distances, which could go, in some cases, up to several

hundred kilometres. Therefore, such an implementation would be impractical in many European countries.

The RSPG draft opinion also recognizes that Member States have not made use of the existing regulatory flexibility, apart from some local trials with new services as 5G Broadcast³. However, the opinion does not mention that the 5G Broadcast standard has recently been updated to include 6, 7 and 8 MHz bandwidths, therefore being able to use the full potential of GE06 digital entries, which are harmonized at 8 MHz.

5G Broadcast is to be deployed using existing high-tower, high-power broadcasting sites, currently used for DTT. By choosing modulation parameters that deliver a robust 5G Broadcast signal, good coverage for mobile reception can be achieved without the need to deploy dense low-power networks. Therefore, the introduction of 5G Broadcast alongside DTT would not significantly increase the adjacent channel interference levels, contrary to what the RSPG draft opinion says.

POSSIBLE FUTURE SCENARIOS

Three possible future use scenarios in different EU Member States are discussed in the draft RSPG opinion. The first scenario assumes DTT as the main platform in the 470–694 MHz, to deliver linear television content for at least the 2030–2040 period in a given country. Non-linear content would be provided via broadband platforms and the platforms could be combined through the use of technologies like HbbTV and DVB-I. PMSE would continue using the band and innovation would be possible through deployment of the most efficient technologies (such as DVB-T2 and HEVC video coding).

The second scenario considers that DTT could still be the main platform for linear television but that part of the band could be used for 5G Broadcast and/or mobile services limited to downlink only ((using SDL,

supplementary downlink)). That scenario assumes that both 5G Broadcast and SDL could use existing GE06 coordinated frequencies as well as, potentially, interleaved spectrum, reducing additional coordination efforts. This raises some concerns. SDL is a mobile service that would be deployed by mobile network operators using dense low-power networks. Coexistence with DTT and 5G Broadcast, both using high-power, high-tower sites, would be difficult in terms of adjacent channel interference. This type of interference between broadcast services can be mitigated by co-siting the services. Co-siting broadcasting and mobile services like SDL seems difficult and even impossible when we talk about different types of networks. Adding filters to roof-top antennas is another mitigation option in cases of fixed broadcast reception but it would be impractical in the case of SDL using interleaved frequencies.

The third scenario assumes that the use of the band by DTT in some countries would be limited and that mobile services would implement a full FDD (frequency-division duplexing) band plan with both uplink and downlink streams. This scenario is of high concern for broadcasters because the implementation of mobile uplink services would require significant and probably challenging frequency coordination efforts and PMSE would have a reduced range of frequencies to access.

BROAD AGREEMENT

The RSPG draft opinion provides ten final recommendations. They are broadly aligned with broadcasters' views. A few are worth highlighting here.

FURTHER READING

- For further information on the EBU's position regarding WRC-23, see the white paper *No change at WRC-23 maximizes public value and innovation in the UHF band* (tech.ebu.ch/wrc-23-white-paper).
- EBU Technical Report TR 064 explores compatibility between 5G Broadcast and other DTT systems in the sub-700 MHz band (tech.ebu.ch/064).

The diversity of situations across EU countries regarding television viewing habits makes it impossible to harmonize a single scenario for Europe for the use of the 470–694 MHz band, even after 2030. Member States can use the flexibility in existing regulatory measures to implement different uses and future regulatory measures will need to take account of the diversity of scenarios.

Technical coexistence of the different scenarios is difficult, and solving interference issues requires detailed and complex cross-border coordination between countries. In particular, the RSPG notes that a harmonized FDD plan for the 600 MHz band throughout the EU is not anticipated, and certainly not up to 2030.

In addition to the technical evolution of television services, there are other important nation-specific factors such as market demand, audiovisual policy and sovereignty, which will be crucial in the coming years in shaping the use of the 470–694 MHz band after 2030.

In the meantime, WRC-23 in November will take decisions regarding the spectrum allocations in the UHF band. While both the broadcaster (AUB) and telecommunications (ATU) bodies in Africa and the countries of the Regional Commonwealth for Communications (RCC)⁴ have already agreed a position of 'No Change' in line with the EBU, Europe still needs to confirm its position, hopefully aligned with RSPG recommendations that support the use of the band for DTT and PMSE.

[1] tinyurl.com/rspg-draft; [2] tinyurl.com/lamy-report-ec; [3] tinyurl.com/ts103720; [4] en.rcc.org.ru

Interference – why it happens and what to do about it

Martin Wright, a consultant on electromagnetic compatibility who works with the EBU's *Electromagnetic Interference and Compatibility group*, explains why interference remains a concern and what EBU Members can do about it.

It all starts with interference... There you are, happily sitting at home watching your favourite television show and, suddenly, the picture freezes or starts to break up and you are missing your programme. The programme might start again or maybe the picture keeps breaking up. As a result, you miss your programme. This might be a regular occurrence, or perhaps your picture disappears completely. So, what has happened?

Quite often, this kind of behaviour will be caused by radio frequency (RF) interference, and it can affect any device that receives data through radio waves or cables, not just TV sets. So, what is RF interference, and how does it happen?

All television receivers accept data from a transmission (or cable), decode this data stream, and display the video (and play the audio) accordingly. The interference issue arises either when a signal is so strong that it swamps the receiver and stops it from working, or when an interfering signal is also present at the input to the receiver or in the decoding chain. If the receiver is swamped, or if this interfering signal is in the frequency range that the receiver is expecting, it will try to decode the interfered data. The data correction algorithm will recognize that the data is faulty and will attempt to correct it using forward error correction or a similar technique.

Where this data correction does not work, the system will either await more data or attempt to display the data that it has. This can cause the interference effects on the screen, or in the audio stream, and the user will receive an interfered service.



Interference can be a real annoyance for viewers and can have several possible sources

INTERFERENCE SOURCES

So, we now know what has happened but would still like to understand why. Interference can result from many sources, both naturally occurring – such as lightning – and several manmade sources.

Interference can come from the power mains system and be due to the switching on and off of loads, especially high-power loads, in the network. Examples include washing machines, vacuum cleaners, or an electric drill. Even low-power devices, such as small lighting units, can cause interference if they are poorly designed. Microwave ovens also generate levels of RF that can cause interference.

The failure of electromagnetic compatibility (EMC) components in equipment placed close to a receiver is another common cause of interference. These components are part of the equipment design and are intended to prevent interference from occurring. When these

components fail, due to aging or poor quality, the equipment can produce high levels of interference in receivers either in the same building or in nearby buildings.

Interference is therefore a complex issue. Guidance on how to analyse and prevent interference is produced for EBU Members in the Electromagnetic Interference and Compatibility group (S-EIC). As new devices and systems come to the market, this guidance is reviewed and updated in the group, where all EBU Members are welcome to participate.

Reports of interference from Members or concerns about potential issues can be investigated by S-EIC's experts. The group has a proven record of influencing European and international standards to ensure our services are protected.

Find more information and follow the S-EIC group's work at:
tech.ebu.ch/groups/eic



Anna Holligan and Kate Vandy demonstrating BBC's Bike Bureau



RTBF's Green Production Unit - see it in person on the EBU stand at IBC2023 (10.D21)

Pedalling towards greener production in Belgium and Britain

We often talk about sustainability and efficiency in abstract terms, writes the EBU's **Hemini Mehta**. RTBF's Green Production Unit and BBC's Bike Bureau and are tangible examples of putting goals in motion.

RTBF

The public service media organization of the French-speaking community in Belgium, RTBF, has designed and tested its first fully autonomous green mobile production unit. It is a cargo box sitting on a trailer that can be towed by an electric bike. Three RTBF departments - Mobility, Production and Technology - have contributed to the success of the project.

The unit has been designed to support small to medium-sized productions. It has up to 10 hours of battery autonomy (2,000 W) and a 150 W solar panel. It supports the use of eight cameras and five microphones and has a wireless intercom with three independent audio returns. Installation takes just five minutes.

The initial aim was to create a compact unit with low energy consumption, that meets professional standards and is easy to move around (currently weighing 149 kg and measuring 89x185 cm). The team also wanted a unit that could be parked on set, to bring them closer to the crowd.

Being powered by electricity from a renewable source, the unit can be used in the middle of nowhere, with no need for an electricity connection or a diesel

generator.

Recordings can be saved locally or transmitted live via 4G. The unit includes an HD recorder using SD cards, an audio and video workstation (Zoom L-12 and Skaarhoj's Live Fly), and two configurable multi-viewers connected to a live production mixer (Blackmagic's ATEM 2 M/E). Everything is prewired inside the cargo box, saving time and energy. Users just have to connect their video and audio equipment to the patch panel. Additional storage space is used for the two batteries.

The trailer can be attached to an e-bike (that supports up to 200 kg) or pulled by hand and can be parked pretty much everywhere (indoors and outdoors). The Green Production Unit rider is paired with an Urban Arrow rider, with cameras and lighting equipment stored in the front cargo box. The unit can withstand strong winds and pouring rain (it has most certainly been put to the test).

Currently in its pilot phase, the unit has been tested for a small production at the national book fair. The team is still working on making the best version possible and eager to share the project with the international audiovisual community.

BBC

BBC too has launched a bicycle-based sustainable production pilot project this year - the Bike Bureau. The brainchild of two of the organization's journalists, Anna Holligan and Kate Vandy, it is a mobile broadcast studio on two wheels. They transformed an electric cargo bike, using off-the-shelf broadcast kit, into a vehicle that can offer solo-operated (and solar- and battery-powered) live contributions for television and radio, as well as carry out all manner of newsgathering tasks.

The development of the Bike Bureau started in 2020 when Anna and Kate worked on a documentary called Europe's Cycling Revolution, examining the impact of COVID-19 on urban mobility. Inspired by what they saw, they wanted to make changes in their own lives, which is when the idea was born.

As a mostly solo-operating journalist, for Anna this hyper-mobile device has revolutionized how she works, providing the most transparent time-, cost- and energy-efficient way to gather and report the news. Anna and Kate hope when others see the Bike Bureau, they might be inspired too.

Is the role of technology in the boardroom changing at public service media?

Willem Roskam, Chief Technology Officer at NPO, the Dutch public broadcaster, explores how rapid change in the media technology landscape is impacting on roles in the boardroom.

The world around us is changing fast. Technology is rapidly advancing, and media consumption behaviour is changing at an ever-increasing rate as well. Public service media (PSM) must move from a 'one-to-many' to a 'one-to-one' publishing model, in which it is crucial to ensure that the right relevant content, as required by the remit of PSM, is available to the audience at the right time and on the right device. We are engaging directly with our audience members, who expect a seamless experience with our content, whether via linear television or via the PSM video-on-demand application on a smart TV, smartphone or tablet.

Technology has long since ceased to be an amenity like 'water from the tap'. The proper use of technology is essential in order to make possible the omni-channel content experience that is needed. A fully integrated content and metadata publishing chain, well-functioning digital products that are valued by the public, and the use of user data to enable an improved user experience – in 2024, a PSM organization can no longer do without these things.

To facilitate this, it is relevant to consider how the board is organized, what its focus is, and whether it possesses the right expertise. The composition of boards is changing, and necessarily so. If they are not already in place, a Chief Information Officer or Chief Technology Officer are being added, as well as other new portfolio managers such as a Chief Data Officer, a Chief Product Officer, or a Chief Transformation Officer.

To increase the organization's clout with regard to the digital transition, it is important for PSM



Willem Roskam, NPO

to recognize that the board must have sufficient relevant knowledge of technology, digital products and data. But what does this mean for you as a CIO or CTO in a perhaps somewhat traditional board?

As CIO or CTO, you must take full responsibility for all aspects of the technology needed to enable the digital transformation.

Establish connections between the traditional production and broadcasting technology teams and the teams working in the fast-paced world of digital technology. Help them understand each other's world to make certain that they are able to work together on an integrated content and metadata publishing chain.

'Data' and 'product' may be new disciplines. Ensure that they are properly represented and embedded in the board. You could choose to incorporate these disciplines in your own portfolio, so as to unburden the

business department of the organization and help them achieve their objectives. In that case, it is important to steadily guide them towards the new way of thinking: putting the audience first, delivering content based on its value for the audience, and data-supported decision-making. Only in this way can you create that good 'one-on-one' relationship with the audience and facilitate this transition as CIO/CTO by applying the right technology and incorporating the use of data within the digital product portfolio.

BREAKING WITH TRADITION

To accelerate the digital transition, 'content', 'product' and 'technology' disciplines must always be well represented and embedded in the board. This is not always self-evident, as many PSM still focus heavily on radio and television. Above all, apart from the embedding of these disciplines, it is paramount that they work together as much as possible to achieve the jointly set objectives. In my opinion, setting up multidisciplinary teams across executive boards is a prerequisite to make this happen. Traditional divisions within PSM need to be overturned!

In short, as CIO/CTO we have for years felt responsible for the 24/7 operation of our PSM organization and all the technology that involves. But today, more is expected of us. Allow yourself time to take a critical look at the way your board is organized. Consider your role in it. What changes are needed to accelerate the digital transition?

I, too, am still in the process of discovering what would work best for NPO. Do you know? If so, I would very much like to meet you for a cup of coffee at IBC2023 in Amsterdam!



A perpetual passion for ensuring digital television reaches its full potential

Three decades after digital television launched, the Digital TV Group (DTG) has a crystal-clear vision for the future, writes CEO **Richard Lindsay-Davies**.

Ours is a sector in which the pace of change (and the rhetoric around it) is unceasing.

Innovation, technology and opportunities proliferate in every part of the chain from concept to consumption. And yet, our fundamental mission and purpose at the DTG remains as essential as when we were planning the world's first digital terrestrial launch in 1995.

That mission is to ensure UK digital television reaches its full potential by innovating with industry to deliver long-term growth, centred around an egalitarian vision that digital television is for ALL. It has to be open, available, affordable, safe and, of course, interoperable. Our innovation, transformations and transitions must be fair, elegant and, because it bears repeating, work for ALL.

Everything we, as an industry, have built in digital television was enabled by transformational disruptive technology; from the availability of low-cost, high-performance computers to camera and display innovations that made high-quality images affordable and accessible. Advances in audio technology brought television to life and the World Wide Web grew, standardized by W3C around the same time we were created in the 90s. Reaching our full potential still relies on the power of disruptive technology.

Our research, work and collaborative innovation drives interoperability through the best technical standards, addresses the challenge of competing UI (user interface) and data ambitions, and ensures the end-user experience remains uncompromised. And the next phase of disruptive innovation is more complex and uncertain than anything DTG members



Richard Lindsay-Davies, Chief Executive Officer of DTG

have experienced before.

Which means we are bravely seizing new transformational technologies for good – revolutionary and responsible are not mutually exclusive – openly embracing the opportunities provided by future connectivity, next-generation computing, AI, virtualization, quantum computing and cryptography, and distributed architectures, and all at 30x programming speeds.

The excitement – and the challenge – of achieving business ambitions lies in successfully joining together, for the first time, two massive and fundamental economic systems, both going through once-in-a-generation transitions: national television and the global internet.

ACTIONABLE CHALLENGES

Moving beyond a shared urgent need to prepare the market for an all-IP future, our *'Pathway to the Future'* research has

identified high IMPACT enablers for businesses or individuals to create meaningful, user-focused experiences; innovations that critically meet success criteria across the business, from the product champion to finance and the chief executive.

As applied digital television researchers and technologists, we are mobilizing our diverse network of individuals and companies to tackle the 25 actionable challenges identified in our research. These range from consumer-centric factors such as ESG (environmental and social governance), ease-of-setup and use, single-sign-on, trust, safety, and cybersecurity – the latter which we address with our SafeShark secure-by-design initiative.

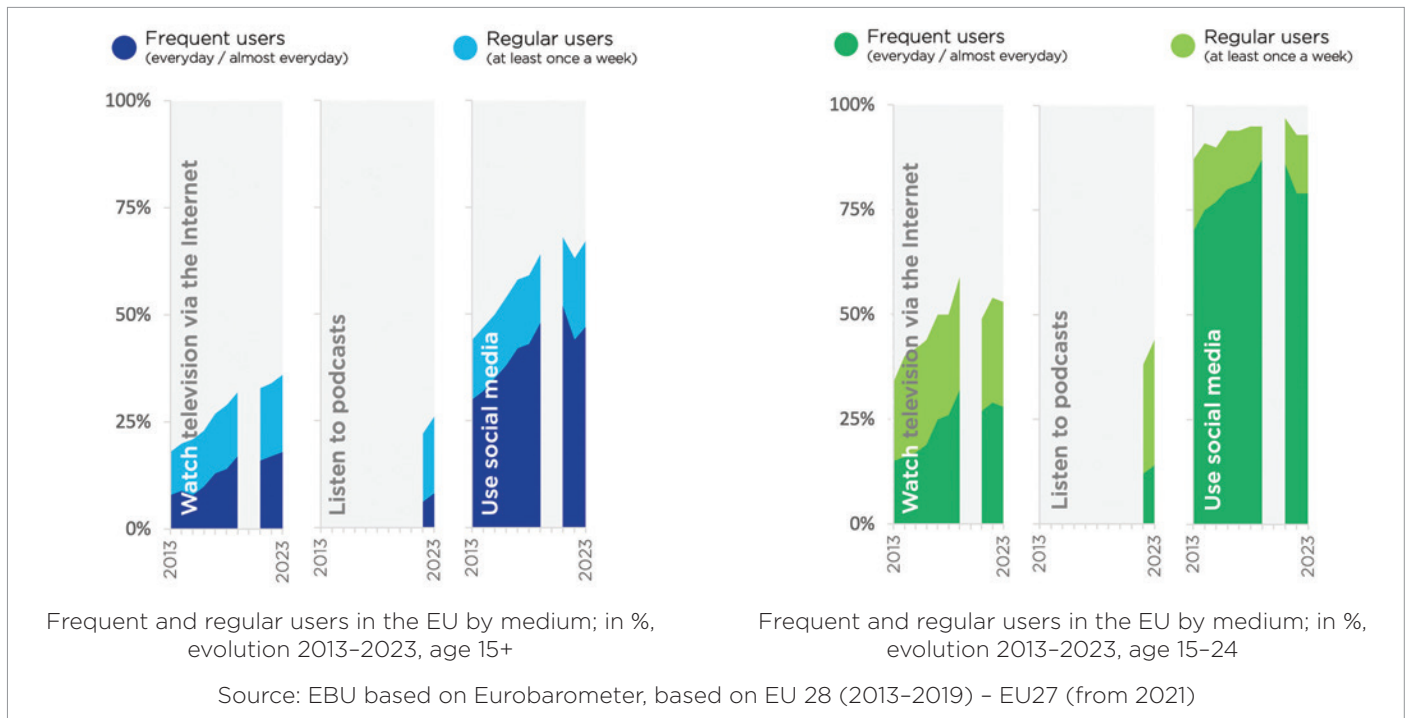
Of course, performance, resilience and interoperability remain critical to achieving that full potential, right down to exploring how AI and personalization may help improve accessibility, including for those neurodiverse viewers who are not currently fully considered.

And, we are exploring new possibilities in distribution via projects ranging from OpenRAN 5G, developing scale with hybrid multicast/unicast systems to ensuring network resilience and efficiency.

The DTG is driven by applied television technology research and innovation, enabling the creation of meaningful, user-focused experiences that continue to delight the viewer and keep the UK at the forefront of great telly. For 30 years we've been at the very centre of digital television, and though the axis shifts and the ecosystem expands, it's still as exciting a position to hold as it has ever been!

Video and social usage stabilize in youth while podcasts rise

The EBU's Media Intelligence Service has published its annual report on digital media consumption. **Léa Besson** highlights a few key trends below.



While traditional television continues to have the highest number of regular users aged 15+ in the EU, the frequency of viewing is receding over the long term. At the same time, the number of users of online television has continued to rise overall: +5.9% for regular and frequent users. Nevertheless, for younger citizens, it seems that this year's Digital Media Consumption Trends report confirms the stabilization of online television consumption.

Social media usage is no longer increasing but has rather stabilized, holding second place against all media measured by Eurobarometer in frequent users aged 15+. In youth, the trend is also towards stabilization, albeit at an already very high level: 93% of young Europeans use social media at least once a week. This makes social platforms the top media for European citizens aged 15-24.

PODCAST TRENDS

Newly measured, podcast listening shows an upward trend and sees the strongest increases in percentages: +33% for frequent users between 2022 and 2023. Podcast frequency of listening also increased in young Europeans aged 15-24, where 44% are regular podcast listeners. Spotify, YouTube and Apple Podcasts are battling hard for the top spot in the podcast market, where Spotify does not have the dominance it has in music.

In addition, public service media can be more successful with podcasts even if the big tech companies have taken over the space. In Sweden, Spotify is the main streaming service for listening to podcasts, followed by Swedish Radio. In the UK, BBC Sounds ranks third for podcast listening after YouTube and Spotify. Overall, competition in the audio market is heating up. In Germany, YouTube is the second most important channel for listening to audio content, right

after music streaming services.

Furthermore, just as music videos can be used for listening, podcasts can be filmed and watched. In the US, a recent study showed that the proportion of audio-only listening of podcasts tends to decrease to the profit of listening while watching. Watchable podcasts are particularly successful for 'podcast newcomers' and can be a way to increase podcast reach.

The above insights are drawn from the recently published EBU Media Intelligence Service "Digital Media Consumption Trends Report". See: ebu.ch/publications/research

Sources: Eurobarometer, based on EU 28 (2013-2019) and EU27 (from 2021) / US: Cumulus Media and Signal Hill Insights' Podcast Download - Spring 2022 Report / UK: Ofcom Audio Survey 2023 / Sweden: Svenskarna och internet 2022 / Germany: ARD/ZDF Online Study 2022

IN THE SPOTLIGHT**Robin Ribback**

CHIEF TECHNOLOGY OFFICER FOR ACCESSIBILITY AT SWISS TXT AG



Robin Ribback is a member of the EBU Technical Committee

WHAT ARE YOUR CURRENT RESPONSIBILITIES?

I wear two hats at SRG (the Swiss public service media organization). As an EBU Technical Committee member, I catalyse the strategic partnership between the EBU and SRG, highlighting our shared projects and products. Meanwhile, as CTO for Accessibility at SWISS TXT AG, a subsidiary of SRG that functions as a competence centre for accessibility, I lead a team that is spearheading technological transformations and breakthroughs to make SRG a flagship organization providing accessibility in all areas, and not 'only' in our programme offering.

WHAT DO YOU CONSIDER AS YOUR FINEST ACHIEVEMENT SO FAR IN YOUR CAREER?

I've worked at the forefront of media technology for over 35 years, covering realms like newsrooms, streaming, data, and data centres, with much to celebrate. Nevertheless, my latest achievement is always the pinnacle. Following advice from the EBU, we birthed a virtual organization, The Future Media Hub, led by me and our EBU Technical Liaison Officer, Massimiliano Babbucci, who coordinates SRG's contributions to group work with the EBU. This hub stirs transformation and innovation across SRG, meeting our media organization's evolving needs.

WHAT ARE YOUR PREDICTIONS FOR MEDIA TECHNOLOGY IN THE FUTURE?

Our ecosystem as a public service broadcaster and media organization will continue to change dramatically. I would mention three areas:

Digital shift: public broadcasters will leverage AI, on-demand content, and data analytics to adapt to changing viewer preferences.

Impact of Web3.0: the decentralized internet, Web3.0, will foster transparency, user data ownership, and novel content monetization strategies, like NFTs.

Shared innovation: the future of media technology hinges on collaborative innovation, where open-source culture expedites progress and enriches content quality and accessibility.

WHAT, FOR YOU, ARE THE BIGGEST CHALLENGES FOR EBU MEMBERS TODAY?

As EBU Members, we must solve the challenges together. Collaborative innovation requires a shift in mindset. Overcoming traditional silos to encourage collaboration is a critical hurdle, especially with the need to create joint products and services. Attracting and retaining talent adept at navigating evolving technologies like Web3.0 is a significant challenge that we as Members must address together. Establishing a culture of continuous learning and knowledge transfer, amid rapid technological shifts, is a formidable task.

TELL US ABOUT SOME OF YOUR INTERESTS AWAY FROM THE WORKPLACE.

When I'm not wrangling tech or weaving digital strategies, you'll find me basking in Mother Nature's grandeur, be it atop a mountain, by a serene lake, or in a tranquil garden. Armed with a robust glass of vino, a sizzling barbeque, and a world of friends and family, I love to debate life's mysteries. "Where did that other sock disappear to in the dryer?" always sparks lively discussions!

Join us and the industry's leading experts for technology updates, strategic insights and real-world use cases, plus demonstrations and networking.

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