MEDIA TECHNOLOGY & INNOVATION

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tech-i

T&I Award 2022: Taking 5G in media to new heights

Plus

- **Shining more light on HDR in production**
- **Recognizing young technology talent at Finland's Yle**
- **Annsofi Eriksson on Swedish Radio's technology transformation journey**

and more...

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Cover story: The EBU Technology & Innovation Award 2022 was won by Spain's RTVE for its "5G and beyond" project. Director of Technological Strategy, Pere Vila, explains how the project evolved on pages 10–11. The cover photo also shows the landmark RTVE television tower known as *El Pirulí*, which this year marked its 40th anniversary.
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Contents

Public service media as a growth engine

Antonio Arcidiacono, Director of Technology & Innovation, EBU

The recent EBU General Assembly included an inspiring interview with Tim Davie, Director-General of BBC, which celebrates 100 years of existence this year. Despite all the challenges facing public service media (PSM) today, he struck an upbeat and bullish note. "We can't just be sitting, as public services, managing decline. We're too good for this. I really believe that we're a growth engine."

So, where will we find this growth? How can we build greater resilience into our organizations? How do we become an 'Entrepreneurial Broadcasting Union'?

RESOURCES & REVENUES

As discussed in another interesting session at the General Assembly, resilience will come from making creativity and innovation a strategic objective for each PSM organization. Collaboration and committing resources to developing ideas into concrete projects are together a strong weapon against purely profit-oriented industries. We also need to be creative in mobilizing the resources needed for public good, through applying to European and national funds, as well as partnerships and private funds.

By collaborating across the EBU we can build scale to ensure we continuously reinvent our future. We must seek imaginative ways to be a recognized and leading player in modern, digital societies, including the emerging web 3.0 environments, where we offer citizens a much more active, personalized, and immersive participation in media compared to the past. By wisely choosing our partners in such ventures, we can generate the kind of positive disruption that accelerates innovative solutions.

We must not, as PSM, be afraid to talk about net-positive revenues to support innovation and the evolution of our organizations. Such revenues can also help to trigger new sources of revenue for EBU Members, coming from initiatives that are recent and innovative as well as being in the public interest. If the bulk of our revenues are generated only from legacy sources, then there is a much greater risk of obsolescence.

CONTINUOUS INNOVATION

The growth that Tim Davie talked about will come from having innovation constantly nurturing evolution. This means always having multiple innovation initiatives ongoing, multiplying the options for progress and growth. An important element is finding new opportunities to out-scale competitors, avoiding systematic structural dependencies on big players and with ambitious goals that are not constrained by historical limits.

Continuous innovation and evolution also rely on continuous feedback in the form of data. This is fundamental to anticipate the risk of failure and build continuous evolution.

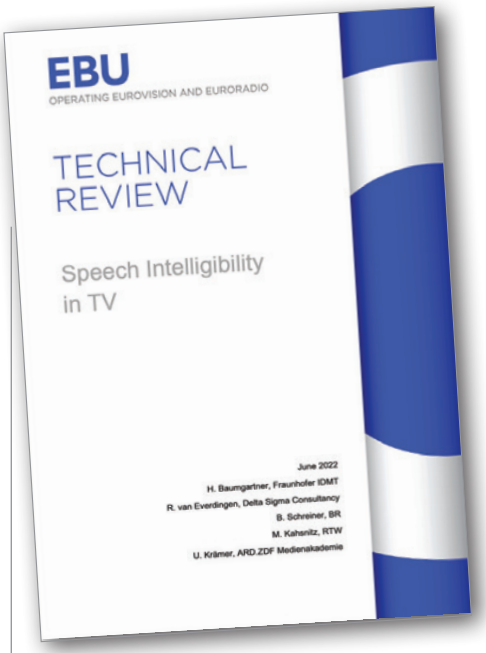
ATTRACTING TALENT

This continuous evolution and the future of PSM will rely heavily on the talent that we can attract and motivate. In this we are competing with many other potential employers, and not just in the media sector. Talent represents the key value of a company and so we must protect our best people. We need them to imagine and promote the future, combining the forces of creatives and technologists. Here, too, joining forces is one way of being able to attract more talent, creating a stimulating environment where they can imagine and develop new ways to inform, educate and entertain European citizens.

Talents are not only your workforce. They are the agents of change. When you share with them a passion for creating new user experiences that enable citizens to relate and connect with each other's stories, you provide the context where new ideas can be born. When people of diverse horizons, skills and genders join forces, those ideas can become innovations and deliver valuable growth, creating the conditions to build our next 100 years of innovation.

"We must not, as PSM, be afraid to talk about net-positive revenues to support innovation and the evolution of our organizations."

New in the EBU Tech Review: speech intelligibility in television



Speech intelligibility of broadcast audio depends on many factors. At the broadcaster, recording, processing, mixing and deficiencies in the transmission chain all play a part. At home, the receiver technology, the acoustic conditions in the listening room and the individual hearing characteristics of the listener all have a bearing.

Despite various recommendations, guidelines, directives and publications, complaints continue to arise. Audience reactions thereby reflect a wide range of individual auditory impressions.

A new EBU Technical Review article examines several factors that can influence sound quality from a programme's conception to its consumption at home, looking at the various technical, economic and even speaker/performance issues that affect speech intelligibility.

The article concludes with a series of "appeals" – to equipment manufacturers, broadcasters and network operators, sound and programme managers, and even to the viewers themselves – that effectively outline several practical measures that can be taken to improve the overall situation with regard to speech intelligibility in broadcast audio. *See:* tech.ebu.ch/publications

New EBU Technical Committee elected

EBU Technical Committee 2022–2024, (left to right): Gino Alberico (Rai, Italy), Karl Petermichl (ORF, Austria), Simon Tuff (BBC, UK), Olli Sipilä (Yle, Finland), Michael Eberhard (ARD/SWR, Germany, Vice-Chair), Michael Nugent (ERT, Greece, Chair), Brian Wynne (RTÉ, Ireland, Vice-Chair), Kazimir Bačič (HRT, Croatia), Víctor Sánchez (RTVE, Spain), Frédéric Brochard (France Télévisions, France), Robin Ribback (SRG SSR, Switzerland), and Kazim Pektaş (TRT, Turkey). Not pictured: Ziad Elmakaleh (JRTV, Jordan).

Nathalie Mastail-Hirosawa

A new Technical Committee (TC) was elected during the 28th EBU Technical Assembly, held in Montpellier, France, in June. The election brought several new faces to the committee, alongside others who were re-elected for further terms.

With previous Chair Judy Parnall (BBC) stepping down, having led the TC since 2018, Michael Nugent, Deputy Director of Technology at Greece's ERT was elected to replace her. His Vice-Chairs are Michael Eberhard of ARD/SWR in Germany and Brian Wynne of RTÉ in Ireland.

New TC Chair Michael Nugent shares his thoughts in an article on page 6, while our regular "In the spotlight" feature focuses on newly elected TC member, Ziad Elmakahleh of Jordan's JRTV (see page 19).

Stepping into the future of television delivery

German public broadcasters ARD and ZDF have joined forces with commercial broadcasters RTL Deutschland, ProSieben and BMT to demonstrate a future-proof television experience in the German DVB-I Pilot. Fourteen other companies are involved as technology providers. "We're pleased to see strong support from across the broadcast industry" says Remo Vogel (rbb), Project Manager of the pilot. "With the pilot project we want to demonstrate a vision for a national market scenario, gather experience with the aggregation of service lists, and identify technical gaps and requirements in the standard."

DVB-I is an open standard that enables the streaming of linear programming over the internet in a way that is as user-friendly and robust as traditional TV broadcasting. It allows enhanced television services to be delivered to any device that has internet access and a media player, including smart TVs, tablets and smartphones. Key features include structured service lists that enable a harmonized user interface, low-latency streaming and many options for additional services, for example HbbTV offers, programme guides, accessibility services, genre-based and event channels.

Furthermore, with DVB-I, the IP streams can be combined with conventional broadcast over satellite, cable and terrestrial. In this manner, DVB-I paves the way for a transition to network-agnostic media delivery. DVB-I guarantees interoperable and platform-independent media access.

Experience the German DVB-I Pilot in action on the EBU booth (10.D21) at IBC2022.

Recommendation on cloud services and sustainability

Published in June 2022, EBU R 170 is a recommendation intended for media companies procuring cloud services. It calls for the inclusion of sustainability factors from the outset of the procurement process, with appropriate weightings given to such factors when it comes to decision making. Furthermore, it recommends that sustainability should be continuously assessed throughout the duration of the cloud services contract.

With the adoption of cloud services continuing to grow, the sustainability obligations of EBU Members extend beyond the equipment and services under their own direct responsibility. Working with external suppliers does not serve to reduce the carbon emissions of the contracting company – instead they are calculated as part of the 'Scope 3' carbon footprint. Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly impacts in its value chain.

R 170 is accompanied by a longer discussion of issues related to sustainability and cloud services. It includes examples from the procurement policies of EBU Members, guidance on internal governance questions, and an overview of cloud-specific emissions to consider. *Download R 170 via* tech.ebu.ch/publications

Media Cybersecurity Seminar

From the war in Ukraine, where cyber-attacks and misinformation remain a big concern, to the ever-present fear of disruption to large-scale sporting events or national election coverage, the topic of media cybersecurity is more important than ever. The annual EBU Media Cybersecurity Seminar returns as a physical event on 18-19 October in Geneva. It's the only industry event focusing on cybersecurity for media in general and public service media in particular.

Find the programme and registration information via: tech.ebu.ch/mcs2022

Bringing the Technical Committee closer to Member priorities

Michael Nugent, Deputy Director of Technology at Greece's ERT, was elected as Chair of the EBU Technical Committee (TC) at the 2022 Technical Assembly. He outlines his main priorities.

The media landscape is changing at a fast pace and an escalating battle to appeal to audiences across more platforms and delivery mechanisms is raging among content providers. A 'one-size-fits-all' content delivery strategy is no longer enough to address the digital gap created by the disruptive environment of streaming media and to meet the changing expectations of our viewers and listeners. It is therefore paramount to understand our environment so that we can exploit new opportunities and ensure a successful future for public service media (PSM).

Michael Nugent is the newly elected Chair of the EBU Technical Committee

NEW ACTIVITIES

Our workplan should reflect this changing landscape as it is directed towards the digital transformation of PSM organizations. An update to its scope, objectives and deliverables was endorsed during our EBU Technical Assembly in June, with new activities emerging from the Strategic Programmes. These include projects and studies in production technologies (LED-based virtual production, real-time CG animation, the metaverse and NFTs), in cloud-based architectures (GAIA-X), in distribution network technologies (optical fibre roll-out and deployment), and online platforms (HbbTV, modular content and segmentation, connected cars).

The war in Ukraine, however, has brought grave implications for the global financial system and consequently restrictions in financial resources for the EBU. It is therefore important to concentrate on efforts that maximize the achievement of our goals. The Technical Committee has identified four areas to focus our actions on: to become more audience-centred, offering highly relevant content and services to our audiences; to collect and use data in a responsible way; to use our own media platforms for a direct relationship with our audiences; and to build workforces that guarantee our future.

We must also strengthen our collaboration with other bodies and committees within the EBU, so that we can collectively work on common challenges, especially around digital content transformation. With global media and tech giants dominating the market with their platforms, we must be able to develop our own collective ecosystem where all Members have a role to play, as well as unite in our efforts to achieve prominence on third-party content-aggregation platforms. We must also collaborate with organizations outside the EBU that have a key role in our industry, to address fundamental issues of mutual concern.

MEMBER COLLABORATION

Fostering innovation and sharing our knowledge and expertise among EBU Members is key to our growth and sustainability in an increasingly digital, mobile, and social media environment. To create further synergies between the activities of our Members, we must continue our efforts in building innovative products on a pan-European scale and seeking opportunities to fund their growth.

It is also important to strengthen the TC's engagement with the Members, so that all contribute to the work ahead and benefit from it. Within the TC, we are exploring new communication channels with the technical staff and management of all Members, so that our workplan addresses more accurately their emerging requirements. This will include focused meetings with Member CTOs and a more comprehensive collaboration with the Technical Liaison Officers (TLOs), our focal points for the technical activities of the Members.

We must also proactively engage with the new generation workforce, increase awareness, and encourage more diverse Member representation in all activity areas. Our strategic roadmap should improve access, remove barriers, and increase the opportunities for women, in particular, within the TC's activities, so that greater diversity is achieved in the next elections.

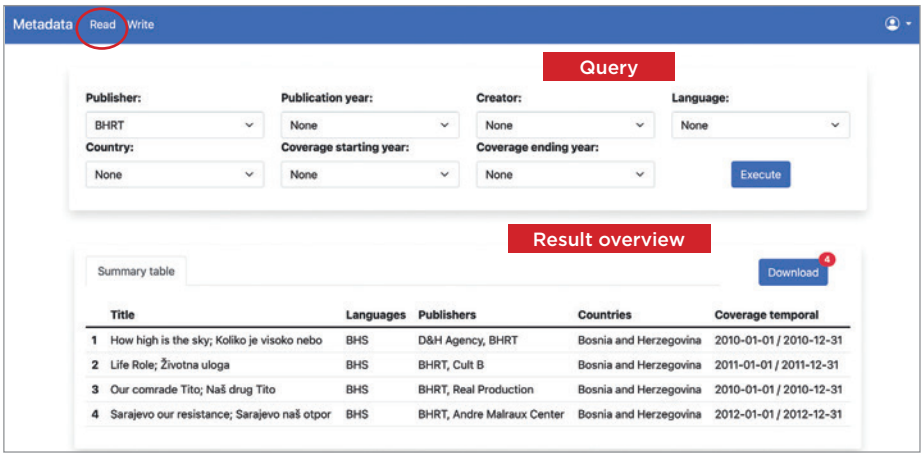
Nathalie Mastail-Hirosawa

Opening a window on audiovisual archives in the Western Balkans

Alexandre Rouxel describes a recently launched platform, built by the EBU, that should facilitate increased cooperation between PSM organizations in the Western Balkans.

A unique regional platform for the exchange of metadata related to audiovisual archives was launched in July. It was developed within an EU project to provide technical assistance to public service media (PSM) organizations in the Western Balkans (see separate box).

The Archive Metadata Exchange Platform, built by the EBU as one of the project's consortium partners, is flexible, scalable and easy to use. It leverages the full capabilities of graphical databases and knowledge graphs. It is hosted in the cloud for easy access but with minimal adaptation it can be deployed on site or moved between different cloud platforms.



A screenshot of the user interface, showing the results of a search query

CONNECTING & SHARING

The aim of the platform is to present a window on the material held in the audiovisual archives of PSM organizations in the Western Balkans. It provides basic information about the content available, the title, format, source, date, rights and description, and should be the basis for the exchange of the material on a bilateral or multilateral basis.

By connecting and sharing metadata and knowledge, this platform enables the development of joint actions and productions between PSM organizations. For its launch, the platform was initialized with the metadata of 884 hours of archive content, representing 1,302 items. This metadata list was prepared by the Western Balkans' PSM organizations in cooperation with Austria's ORF, another of the project's consortium partners.

CLOUD OR ON PREMISES

From a technological point of view the platform is a graph database exposed via a user interface that generates pre-coded queries for reading (see diagram) or writing. It offers the participating organizations an efficient way to share digitized content and explore the associated metadata.

The exchange platform is deployed on Amazon's cloud platform but does not rely on it for the user interface or user management services that form the core of the platform nor on the AWS proprietary graph database. It can thus be moved to other cloud providers or to on-premises servers without development effort.

In terms of usability, the architecture has been designed to make interaction with the graph database easy for non-experts. For reading, the user interface generates pre-coded queries that are sent to the graph database to gather data. For writing, an Excel-based template file is used to generate queries that feed the graph database with formatted data. The platform automatically checks the conformity of the metadata and warns the user in case of a problem and asks them to reformat. This is a way to guarantee and maintain the quality of the database, which will be fed by many contributors. The quality and searchability of the ingested data are thus guaranteed.

WHO IS INVOLVED?

The Technical Assistance to Public Service Media in the Western Balkans project is a Service Contract of the European Commission that has been awarded to a consortium led by the International Federation of Journalists (IFJ) together with the EBU, the European Federation of Journalists (EFJ), the Austrian public broadcaster (ORF), the Balkan Investigative Reporting Network (BIRN), and the Eurovision News Exchange for Southeast Europe (ERNO). The beneficiaries are the six public service media organizations in the Western Balkans: RTSH (Albania), BHRT (Bosnia-Herzegovina), RTCG (Montenegro), RTK (Kosovo), MKRTV (North Macedonia) and RTS (Serbia). Other stakeholders include the parliamentary committees responsible for media, the media regulatory bodies and the PSM governing bodies.

Shining more light on HDR production

The EBU HDR Workshop at SWR radiated enthusiasm, energy and – of course – sparkling images. **Frans de Jong** (EBU) shares some of the lessons learned and next steps.

Since the HDR Workshop at the NRK in 2019, the topic of high dynamic range was overshadowed somewhat by the pandemic. Last year, the EBU's HDR Implementation Task Force decided that spring 2022 would be a good moment to again shine some light on practical HDR aspects. A week-long workshop, primarily for EBU Members, was thus organized and kindly hosted by Germany's SWR, at its Baden-Baden facilities.

The main goal of the workshop was to learn how to produce HDR, using both live and file-based workflows. For several broadcasters, live HDR production has become common, using workflows that have been optimized to guarantee the quality while limiting the complexity. Andrew Cotton and Simon Thompson (BBC R&D) showed how these workflows are built up, while David Adams (Sky UK) and Andy Beale and Prin Boon (BT Sport) shared their operational experiences.

LOOKING AT SDR TO CREATE HDR

One of the main challenges in live HDR production today, which typically correlates with large events, is that the majority of viewers still watch an SDR image, i.e. standard dynamic range. At the same time, establishing complete parallel HDR and SDR workflows is not the solution, as this would vastly increase both the costs and complexity of the set-up. The trick is to 'downmap' the HDR into an SDR signal (using a static LUT, look-up table) and to use that SDR signal as the reference for shading the cameras. This so-called 'closed-loop shading' approach guarantees the HDR and SDR signals track and that viewers without HDR at home are not treated like second-class citizens.

During the fourth day of the workshop, an industry day was held, where broadcasters spoke with industry partners about the key points to address in equipment and operation. The use of downmappers was one of the aspects raised.

The problem is that when broadcast parties exchange signals and are using different downmappers, it becomes hard or even impossible to guarantee quality downstream. Visual 'tweaking of the ProcAmp' (the processing amplifier that can adjust various aspects of a video signal) is not a recipe for success. This scenario is not just academic; it has been faced in the recent past during large live events. At the workshop several ideas to address this issue were proposed and it was agreed to set up an open group to continue the work.

See tech.ebu.ch/hdrdm for more details on the new HDR Downmapping group.

EQUIPMENT IMPROVEMENTS

Another point made in Baden-Baden was that camera matching can be hard when cameras from different manufacturers are involved. Although at the workshop it was shown that it can be done successfully, having a common starting point for the different devices could help gain time in operation. Such an 'EBU preset' would not be intended for broadcast, but a fixed base from which an artistic look can be applied.

Another time-saver would be the more extensive use of video payload identifiers (VPIDs) in video signals. These make sure receiving equipment knows the format of the signal. Questions such as "am I really looking at a BT.709 colour signal?" are then no longer needed. Although improving, it was clear during the workshop that not all equipment supports the VPID (yet). For some devices (e.g. LUT boxes) this is logical, as they may not be able to automatically deduce the signal type. In this case, an option to insert the VPID manually would be a very useful addition.

FILE-BASED LESSONS

Pierre Routhier (CBC/Radio-Canada) led the post-production part of the event. He shared his experience with HDR grading and transformation, including how the extra time available in post-production can help achieve superior results to 3D-LUT based

Clockwise from top left: Andrew Cotton (BBC R&D); participants in the industry day; Andy Beale (BT Sport, left) and Georg Fürst (ORF, right) helping out with scenes; Pierre Routhier (CBC/Radio-Canada) running a post-production session; participants continued to observe COVID measures when working indoors

approaches. Current non-linear editing software is very powerful, but correct use of the HDR features can be complicated and prone to bugs. The old adage to 'fix things in post' should be seen in a positive light, in the sense that avoiding the application of destructive camera settings (like changing the gain and black levels) is a good idea, to prevent the loss of details and to maintain the flexibility to achieve a different look later.

Producing high-quality images is important, but similar to how audio engineers used to listen to mono car-speakers to check their mix under different conditions, it makes sense to check a professionally graded piece of content on several types of consumer TV sets. As experiments during the workshop showed, their displays have widely different ways of handling HDR content and generally tend to ignore HDR metadata. This means images can vary in terms of white point, black levels, gamut, etc. Checking on a professional monitor first and then on, for example, an OLED and a QLED television will give you the certainty of the quality of what you produce and an impression of what the audience may see. Or as Pierre put it: "Some displays are made to 'wow and dazzle', while others follow the standard."

NEXT STEPS

An informal poll at the end of the post-production sessions showed that more than 75% of the participants felt ready to continue with HDR, while a quarter would like more practice and/or training first. This aligns well with the result of a survey held in the first half of the year (available in EBU BPN 128), which showed the vast majority of respondents to be planning UHDTV HDR production for the next 2–5 years. Also in that survey, participants asked for more education on the topic. The HDR Workshop has helped address that need. The EBU will continue to share HDR experience and best practices. Next, an HDR FAQ based on lessons from the workshop will be provided, a demo for IBC is being prepared, and regular calls of the 'HDR Downmapping' group are being held.

A big thank you to all who supported this event! For more information, see tech.ebu.ch/hdrworkshop2022

How RTVE took pioneering steps with 5G for media

The EBU Technology & Innovation Award 2022 was won by Spain's RTVE for its "5G and beyond" project. Director of Technological Strategy, **Pere Vila**, explains how the project evolved and what is planned for the future.

We were convinced that the arrival of 5G technology could help us to effectively and efficiently improve three very important aspects of television production: having permanently connected cameras, being able to make multi-camera productions in the cloud (or on the edge), and implementing new forms of broadcasting, capable of making an impact on new devices (smartphones, tablets) and enabling new forms of digital consumption.

CONNECTED CAMERAS

Although we are used to perceiving the camera as a device that not only captures but also stores the image, our business need is somewhat different. Once the image has been captured, what really gives it value is having this image available in the editorial suite and not only in the camera's memory.

The possibility of equipping our cameras with a means of being permanently connected, providing our editorial teams with immediate access to the images captured, creates enticing new possibilities for our news and current affairs departments.

Our interest led us to carry out one of the world's first live television connections using a standalone 5G network (5G SA); this was in Valencia in 2019. 5G SA allows the creation of a network that is independent of the cellular network used by the public. Additionally, such a network can be segmented into sub-networks with different transmission capacities, speeds and latencies. We also installed a permanent 5G small cell, known as a small area wireless access point (SAWAP), in the regional parliament of Castilla–La Mancha and used it to deliver the first

José Manuel Ortega Elgueta

productions using the network-slicing possibilities offered by 5G technology. Network slicing is an architecture that allows the creation of independent virtualized logical networks that all use the same physical network infrastructure.

An added benefit of leveraging technology and infrastructures that are closely linked to mobile telephony is the possibility of being able to use images captured by smartphones to complement and support the professional cameras. And this is not only for capturing, but also for editing, sending and being able to offer the first images or live connections while awaiting the arrival of the professional media, which is essential in those cases where immediacy is a priority.

MULTI-CAMERA PRODUCTIONS

The fact that 5G systems make it possible to process data in the cloud or at the edge (i.e. as close as possible to where the data is captured) allowed us to create simple multi-camera productions. These were based on the deployment of remote cameras, connected back to the control room at our studios, and the use of cloud-based servers with video mixing functions.

This use case, with which we had already experimented using 4G technology during the *Manga Fair* in Barcelona in 2018, becomes truly viable with the advent of 5G. Thus, in November 2019 we made a multi-camera production of an event in the Madrid offices of the European Parliament. For this we used a 5G deployment intended primarily for mobile telephony.

This was the first successful test of a series of 5G-based productions that we accomplished with the help of the RTVE Territorial Centre of Toledo and our colleagues from Radio 3. We also made the first productions deploying audiovisual services on servers at the edge of telecommunications networks, again in Madrid.

NEW FORMS OF DELIVERY

The mobile phone is a device that practically the entire population owns and uses constantly. The possibility of offering our broadcast television and radio content to these devices in broadcast form is not a trivial idea and is one that we also wanted to explore. We are aware of the IP access possibilities of smartphones and how easy it is to download and store films or entertainment content. This is why we wanted to experiment with public service channels with a high incidence of current affairs or information.

It is with this concept that we carried out different broadcasting tests, in this instance in Barcelona, coinciding with the Mobile World Congress in 2022. We did this

with companies like Cellnex, Cires21 and Rohde & Schwarz for the broadcast network and with smartphones equipped with a Qualcomm chipset. The 5G Broadcast solution is based on the feature set of the 3GPP Rel-16 standard and operates in receive-only (ROM), free-to-air (FTA) and SIM-free modes. The dedicated 5G Broadcast mode was demonstrated with a low-power, low-tower infrastructure operating within the UHF band. The content came from our 24-hour television news channels and Radio 5, as well as La 1 television and Radio 1.

The results of these tests were also positive, leading us to think about the possibility of taking advantage of the deployment of 5G to strengthen the broadcasting of public content – both radio and television – linked to current affairs or information so that it can be present on our smartphones.

PROJECT PARTNERS

In order to carry out this set of initiatives and projects, whether for the tests of permanently connected cameras, the multi-camera productions in the cloud (or on the edge) and the new forms of broadcasting, RTVE has relied on specific, multidisciplinary teams, giving special prominence to our territorial centres such as those of Castilla–La Mancha and Toledo.

It has also been considered as an open process, in which several companies and organizations have been involved, including RED.es, TVU, Castilla–La Mancha Parliament, Dolby, Sony, Watchity, Vodafone, Telefónica, Cellnex, Cires21, Rohde & Schwarz, Qualcomm, Telecom CLM, the University of Valencia, the Polytechnic University of Madrid, and the Almagro International Classical Theatre Festival.

Although the project was tough at times, the total commitment of this group of companies and entities must be highlighted here, in an atmosphere of frank collaboration and professional growth for our sector.

Nathalie Mastail-Hirosawa

Christina Bravo and Pere Vila representing the winning team from RTVE, with EBU T&I Director Antonio Arcidiacono and outgoing TC Chair Judy Parnall

5G increases greatly the options for using smartphones to shoot live content

MORE TO BE DONE

This process does not end here, and there are four lines of work on which we continue to advance:

- To consolidate and finish reinforcing the services with the incorporation of network slicing, improvements in practical aspects of production linked to intercom, signalling, coordination, and orders. We must also observe if and when the commercialization of smartphones with chipsets to receive 5G broadcast takes place.
- To gradually deploy these services in our companies as a complement to the current infrastructure, always benefitting from both worlds and keeping an eye on cultural aspects.
- To initiate tests to incorporate UHD into the scope of our work on 5G. To explore the possibilities of capturing and sending UHD signals over 5G infrastructures and to deploy UHD production tools in the cloud or on the edge.
- To incorporate artificial intelligence processes applied to production on the edge, with services such as semi-skimmed production, automatic metadata enrichment, etc.

In our opinion, public companies such as RTVE must commit time and resources to the incorporation of these new technologies in our work, even though our public structure, size and territorial deployment make such commitments more complex. The only way to overcome these complexities is to apply innovation.

I would like to end this article by thanking the EBU and our colleagues across the EBU membership, professionals who are our reference and who we value very highly for the recognition they have given us. We are doing a job that we like very much and that enables us to work alongside excellent companies and entities in our sector.

A hub of cutting-edge technology in broadcast media

EBU Technology & Innovation Award ★RUNNER-UP★ 2022

The unique IP infrastructure of the Canadian public broadcaster's new French-language headquarters in Montreal was recognized in this year's EBU Technology & Innovation Awards, coming second overall. **François Legrand**, Senior Director, Core Systems Engineering, tells the story.

CBC/Radio-Canada is Canada's national public broadcaster. Through our mandate to inform, enlighten and entertain, we are undertaking a transformation to meet the needs of Canadians in a digital world. When our Montreal production centre, built in 1973, reached the end of its lifespan, we seized the opportunity to move to a new, unique and innovative French-language headquarters.

Construction of the new Maison de Radio-Canada (NMRC) began in summer 2017 with the goal of creating a content production system based on emergent IP technologies. Our technical teams, end users and outside technology suppliers worked to build a versatile, adaptable facility that could operate as a major content production and distribution hub. Overall, the building supports 16 linear television channels, 65 news, talk, and music radio stations and their corresponding digital streams, along with a host of digital-only services.

The new Maison de Radio-Canada; inset, Mathieu Rochon and Alexandre Dugas represented CBC/Radio-Canada at the awards ceremony during the EBU Technical Assembly in Montpellier

Inset: Nathalie Mastail-Hirosawa

STIMULATING & SUSTAINABLE

First and foremost, the NMRC was designed to be a stimulating work environment for 3,000+ employees. It also needed to have infrastructure that would be capable of meeting today's production requirements and beyond. Achieving operational savings by reducing the square footage and maximizing equipment efficiency to reduce energy consumption were also high priorities.

As of spring 2022, all radio, news production and post-production operations were fully migrated and up and running in the new building, alongside administrative services. The NMRC now includes a content playout and master control facility, eight video control rooms, more than 10 studio floors, 20 radio studios and booths, 40 editing suites, and a 156-cabinet state-of-the-art data centre.

FLEXIBILITY, AGILITY & SCALE

CBC/Radio-Canada creates and distributes content in French, English, and eight Indigenous languages, which necessitates infrastructure that is flexible enough to meet daily production requirements, agile enough to be reconfigured to handle special events (e.g. national and local elections, Olympic Games, major breaking news) and scalable enough to evolve in step with an ever-changing media landscape and technological advancements.

Traditional infrastructure is constrained by the limitations of HD-SDI routers; large facilities typically house small independent production islands linked by a facility router. In the NMRC, all production equipment is centralized in a data centre and interconnected via massive network infrastructure, creating a pool of shared, dynamically allocated resources that can form virtual production systems tailored to specific production needs. Once any given production is complete, its resources are relinquished for immediate use by another.

Our IP technologies allow virtually unlimited audio/video signal routing infrastructures to be built, significantly boosting flexibility and agility. This maximizes the utilization ratio of equipment while minimizing the amount needed, reducing the costs and carbon footprint of our productions.

Today, more than 400 IP routers constitute the NMRC's IP media network backbone, capable of forwarding 450 Tbps of real-time media traffic and carrying more than 50,000 media flows, making it one of the largest and most ambitious of its kind.

We now broadcast from a live laboratory where large-scale concept testing benefits the whole industry, making CBC/Radio-Canada a leader in the standardization and democratization of IP technologies for real-time media production. We've started sharing lessons and insights with the broadcasting community and we'll continue to do so in the years to come.

Transforming media workflows to increase flexibility and reduce costs

EBU Technology & Innovation Award ★ RUNNER-UP ★ 2022

Madelen Ottosson of SVT describes how the Swedish broadcaster is stepping towards software-based production and distribution through a joint project with Agile Content.

Imagine letting the viewers' quality requirements in distribution determine the production format and bitrate. And imagine unifying the production environment with the means of distribution in the same equipment, using the same software.

One of the biggest challenges for broadcasters today is how to get more content – and more relevant content – produced while maintaining budgets. And the competition from global video and internet services is increasing.

SVT sought a solution that would combine lower costs with the ability to adopt more commonly available technology. We also wanted to be able to leverage the continuous technology advancements we see in mobile phones, the internet, cloud services and CPU/GPU development.

AGILE ORGANIZATIONS

In March 2021, SVT and Agile Content started a journey to a solution that today is capable of receiving several different signals, whether NDI, SRT or SDI. And that is just the start of this solution. It also incorporates operational transformation, requiring fewer specialists, creating more agile organizations and applying DevOps-inspired methodologies, but also enabling a distributed workforce.

In terms of benefits, to lower costs and increased flexibility of working remotely and distributed, we can also add increased relevance of content: the solution leads to more local content, faster reaction times for breaking events and the possibility to develop new formats for an audience increasingly consuming content online and on mobile devices.

K81 is one of SVT's galleries in Umeå, Sweden, where workflows are already in line with the new technical possibilities that the software brings

We have achieved all of this by embracing a fully software-based approach using standard internet and cloud protocols. It uses pure software in combination with workflows inspired by the principles of software-defined networking (SDN), with separated production and distribution video flows and enabling true remote and distributed production.

Using standard internet protocols introduces flexibility to run on a variety of standard platforms and to use a variety of cameras, including mobile phones. Also, building the production pipeline in the cloud using standard protocols allows for fusion between broadcast and other internet concepts and applications from, for example, gaming and AI, catering for new television formats.

OPEN SOURCE

Elastic frame protocol is a new open-source protocol created by Agile Content to achieve the all-important source synchronization. It was developed to use the advantages of IP to adapt quality to preferences and available bandwidth, and to introduce synchronization between cameras, including mobile phones.

This joint project, running for just over a year now, has enabled SVT to take significant steps towards a more digital production model, moving from hardware to software. After several proofs of concept, the first productions on the platform are planned for summer 2022 and, thanks to the innovation-friendliness of the cloud, several further enhancements are planned for late 2022 and onwards. These include introduction of AI and 3D engines for mixing and rendering.

The new platform represents a first big step towards a software environment that is not tied to producing according to a single standard. The goal is multi-format, multi-protocol, multi-bitrate software-based production.

Using virtual sets to simplify production design processes

EBU Young Technology Talent Award ★ WINNER ★ 2022

Media Technology Specialist at Finland's Yle, **Petri Karlsson** was the winner of this year's EBU Young Technology Talent Award, in recognition of his groundbreaking work on virtual production planning. Here he describes how the project, known as Orter, developed.

In spring 2021, Yle investigated the use of point clouds in the workflows of visual professionals, such as those designing graphics, lighting and sets. The purpose was to create an accurate virtual 3D replica of the production site, so that everybody would have the same 3D model as a starting point for design. The concert hall at Helsinki Music Centre was chosen as the space to be 3D scanned, as Yle has weekly productions there. This complex space with widely varying height differences was well suited for comprehensive testing. While lidar scanning was a convenient technique for visualization and digital measurement of spaces, unfortunately it wasn't possible to import the point cloud *as is* into all visualization software, so the space also needed to be 3D modelled on top of the point cloud.

Petri received his award from EBU Director of Technology & Innovation, Antonio Arcidiacono, and the outgoing chair of the Technical Committee, Judy Parnall

POINT CLOUD TO ORTER

In the late summer, we decided to build on this positive start by combining the point cloud and the plans of the visual professionals on a single platform. Unreal Engine was selected because of its versatile import possibilities, high-quality real-time rendering and easy programming. The project was initially referred to as a virtual production-design tool, based on the goal of transferring the designing of live television shows, fiction and events at least partially to the virtual world. Later, it was branded Orter.

Orter developed rapidly throughout autumn 2021, in cooperation with various Yle colleagues. Rami Lindholm, the foreman of Yle's directors, had a particularly strong influence on the development work, seeing the potential of Orter at a very early stage.

During the development we tried to use Unreal Engine's built-in features as much as possible, but we also programmed completely new features; for example, four different types of camera controller, video-based motion capture workflow for virtual human movements, and a library of widely used camera lenses and sensors, allowing the production site to be viewed as if through a real camera. However, for directors the most important feature of Orter is the CuePilot integration, which allows the director to cut between virtual cameras straight from the CuePilot timeline. Thus, entire productions can be cut in advance in the virtual world.

FIRST USER EXPERIENCES

Following some pandemic-related delays, the first real technical test was carried out in March 2022, when camera locations and the positioning of the AR graphical elements were planned in Orter. The test went well, and we soon agreed with the director Rauli Valo on the virtual pre-planning of the *Moves like Summeri* production that aired at the end of May. The virtual design was a success: the camera positions, placement of the graphics on the projection screen, layout of the sets and cutting of the programme with CuePilot were all designed virtually. This freed up valuable time for other programme development activities.

Although Orter has so far only been used in one production at Yle, the goals set for it have mostly already been achieved. We have proved that Orter unifies the production team, significantly facilitates the director's work and reduces the margin of error. It makes it possible for the entire production staff to gather in a virtual space that corresponds to the real production site and plan the production together.

Most of the components needed for the virtual design of a television programme are already available in Orter, but further development is ongoing. For example, the transition to version 5 of Unreal Engine will happen later this year. We are also collecting 3D models of frequently used production locations in a library and creating presets for typical camera movements.

Deploying mobile energy solutions for media production

Having started in the energy-intensive world of container shipping, Skoon Energy soon found that other industries could benefit from its know-how in clean, modular energy. **Tara van de Lagemaat** provides some examples from media production.

By using swappable battery containers as big electric powerbanks, Skoon Energy was able to bring clean and modular energy to container shipping. That modular way of thinking turned out to be very useful for other industries too, including the film and television industry. We created an online marketplace, Skoon Sharing, that solves the challenge of finding the right type and size of energy system as new technologies come to market. From a small portable battery for powering lights to a container-sized solar generator for the entire filmset, for every project there's a solution.

Data is a key element of making clean mobile energy available. Our data and analytics platform provides insights into the energy profile and impact (such as savings in costs, CO_2 and NO_x) of every rental. In addition, smart algorithms help improve the energy system set-up for every rental.

Choosing the right combination of energy systems for a temporary power supply is typically where we see film and television companies struggling. There are many solutions available, all with different technical compositions (e.g. lithium, solid state batteries, hydrogen, ammonia, etc.) and power specifications (kWs, kWhs, amperages and voltages). The two case studies below, both involving EBU Members, show what's involved in selecting the right system in this still developing market.

Clean, mobile energy solutions come in many shapes and sizes; a trailer-mounted battery can be easily moved around the set

LOCATION SHOOTING

A drama series shot in the UK faced a choice between either deploying uncomfortably long cables or using a noisy diesel generator to power the equipment when shooting in a village. We visited and analysed the energy needs in detail, including by looking at the kit that was used on a typical day and how the usage of that kit was concentrated, to determine the peak power demand.

This resulted in the selection of a trailer-mounted battery, such that it could be moved around the location, with enough capacity to power lights, cameras and scanners at the same time, and for a couple of consecutive hours, without recharging. The battery system was charged at night on a standard grid connection, ready to be used the next day.

CATCHING PEAKS

In another example, a reality TV show was provided with a container battery system that served two purposes: 'catching' peaks in the energy profile that the grid connection couldn't handle and delivering an uninterruptible power supply (UPS) for when the grid experienced a blackout and failed to deliver power at all. The setup was completed with a back-up diesel generator that would charge the battery in case the grid was unable to. With this setup, one continuously running diesel generator could be eliminated from the set. This resulted in (ongoing) savings of 1,500 litres of diesel per week!

At Skoon, we are keen to learn together with our partners. Despite the fact we've been active in the film and television industry for a few years now, there is still a lot to learn. We're happy to talk to anyone who would like to explore further the use of clean energy on demand.

The split situation – what it means for tech transformation

Standing in a technological split, SR is on a digitizing journey where traditional and new technology need to seamlessly cooperate to create an excellent audience experience on both FM and on SR's digital platforms. CIO **Annsofi Eriksson** reveals the success factors.

Swedish Radio's vision is "More voices and more powerful stories for a greater understanding." Supporting it, our new production strategy relies on three pillars: data-informed, location-independent and audio-aware. We have a clear view on how to continue our digitization journey, driving technology transformation with audio in focus.

Nevertheless, our audience still shows a need for linear radio while simultaneously increasingly embracing new formats and on-demand listening. Similarly, our FM platform remains strong while the audience also demands a digital platform that can compete with other streaming platforms. This puts us in the famous split position: one leg is still in traditional technology and the other is in new technology, trending towards IP networks and generally more IT in all functions.

This position has resulted in a hybrid of traditional and new technology. Our technology transformation is full stack, from server and network modernization through core applications to the audience-facing web applications. To avoid losing the audience along the way, we combine traditional and new platforms in a way that ensures a seamless experience when moving between FM and content streamed on demand.

We develop applications in-house where needed and use third-party products where possible. Further, we have started moving towards a hybrid cloud strategy, analysing how to balance on-premises and off-premises workloads, as well as related automation, compatibility and management requirements.

To make sure our listeners find our combined offering, our digital strategy has moved from aiming to reach the audience on any platform, third-party or our own, to obtaining as many listeners as possible on our own platforms. Our overall strategy to win this battle with the big dragons, in our split position, is to be totally audio focused.

Annsofi Eriksson, CIO of Sveriges Radio

Micke Grönberg

SECURING COMPETENCE

We must ensure that we have the necessary competence to maintain stable, high-quality FM and streaming distribution and at the same time prepare for providing our content through the new technology platforms. To attract the right competence, we believe that offering employees outstanding possibilities to develop, whether in preferred technology or other areas, is golden.

The connection between being a preferred employer and offering good digital workplaces has been there for some time already. The pandemic and general changes in work lifestyles and technology have made the digital workplace an even more critical factor in attracting competence and allowing for individual preferences. We are thus giving this an even higher priority in future. Already now, we have established a separate department for digital workplace services in SR, responsible for driving the area strategically, tactically and operationally.

NEW WAYS OF WORKING

We have implemented modern, agile working methods throughout our tech teams in the last two years. The first phase has been brave, ambitious and successful. We are now stepping into the next phase, assessing the release train structure for potential improvements.

With some years of experience of agile operations and the technology transformation ongoing in parallel, we need fine-tuning to allow teams to collaborate in new constellations to keep the balance in our split situation and to progress towards new target technology. Our plan is to define value streams for primary targets and attach the right teams and people to those streams to work closely together. This will eventually create the next generation of the agile release train.

The technology split will continue for some years. This demands the entire organization to start discovering and preparing new ways of working to maximize the benefits from new technology. To make this happen, cooperation between business and IT needs to be even stronger.

Perhaps most important is being proactive and curious on a personal level and daring to try out new things, outside one's comfort zone; endure defeat, learn, and move on.

Securing the future of audiovisual content creation

The Association of Professional Wireless Production Technologies (APWPT) is the stakeholder group fighting for the frequency resources needed by PMSE. Its chair, **Wolfgang Bilz**, introduces the organization.

PMSE – programme making and special events – describes a wide variety of wireless applications that allow content creators to capture, produce and distribute audio and video content over broadcast networks or other distribution channels to audiences at home or, increasingly, on the move. While PMSE is the term used in Europe, the Middle East and Africa, elsewhere in the world the terms SAB/SAP (service ancillary to broadcasting/production) are also used.

In 2008, users and manufacturers of wireless production tools founded APWPT as an international stakeholder group that could speak with one voice. When APWPT started, only a few administrations recognized PMSE as an important application. It took several years and many meetings on national, regional and international level to gain the recognition from regional organizations and administrations that we have today. As an example of our progress, today PMSE is mentioned and recognized in every discussion paper or consultation document on the future of the sub-1 GHz frequency band.

APWPT members include user organizations, public service media organizations, sound and video engineers, and manufacturers. National activities are conducted by local APWPT partners (BEIRG in the UK, AFIAL in Spain, PMSE.NL in the Netherlands, etc.) and local representatives speaking on behalf of APWPT.

Wireless PMSE equipment has become indispensable for the content production sector thanks to the flexibility it brings to production workflows. However, it must continuously meet content production requirements, which are known to be most demanding in terms of audio and video quality and availability. For live audio, low latency is a further critical requirement.

Wolfgang Bilz is Head of Spectrum and Regulatory Affairs for Shure Europe and chairs the APWPT

Access to sufficient interference-free radio frequencies remains essential for wireless PMSE equipment. At the same time, not all frequency bands are technically equally suitable for specific PMSE applications, as different frequency bands have different propagation characteristics that may or may not support production requirements, such as mobility, indoor penetration, latency limits, range, etc.

Some PMSE applications, such as video, intercom, talkback or conference systems, might be able to use frequency ranges above 2 GHz and can accept latencies in the order of several tens of milliseconds. Other applications, such as audio capturing (wireless mics) and playback (in-ear monitoring) for live sound, have such demanding requirements in terms of latency and reliability that operating in the UHF band below 1 GHz is required, due to its favourable propagation characteristics and low body absorption.

UHF THREAT

Currently, the band 470–694 MHz is the core band for audio PMSE applications in ITU Region 1 (Europe, Africa, Middle East, Russia), while video PMSE applications have traditionally operated above 1 GHz, where wider bandwidths have been available and the signal propagation is acceptable.

Agenda item 1.5 at the next World Radiocommunication Conference, WRC-23, is discussing potential regulatory changes for the 470–694 MHz band. Studies currently under discussion in the relevant ITU-R groups suggest that co-channel operation of PMSE and mobile telecommunications is impossible. This fact must be considered in all decisions concerning future spectrum use in the UHF frequency range.

APWPT supports the continuation of the successful symbiosis of broadcast and PMSE with *no change* to the existing rules. We continue to work with administrations towards careful consideration and identification of interference-free frequency bands for audio PMSE operation. Therefore, APWPT is actively involved in CEPT discussions, while our members contribute to national preparation groups for WRC-23 and relevant ITU-R working parties.

Is there a slow down in online media consumption?

The latest report from the EBU's Media Intelligence Service looks at trends in digital media consumption. **Léa Besson** shares some of the findings here.

While traditional media (television and radio) continue to have the highest number of regular users aged 15+ in the European Union, their frequency of viewing is receding over the long term. Nonetheless, this does not necessarily benefit digital media.

SOCIAL YOUTH

With 44% of EU citizens aged 15+ going there almost every day or more, social media continues to be the second choice, after television and ahead of radio, in terms of frequent users. Nevertheless, there was an 8-point decrease between 2021 and 2022 (Fig. 1).

Of young Europeans aged 15–24, 93% use social media at least once a week in 2022 and 79% use such platforms almost every day or more. This makes social platforms the top media for European citizens aged 15–24. However, in this demographic, the proportion of regular and frequent users also decreased quite significantly between 2021 and 2022.

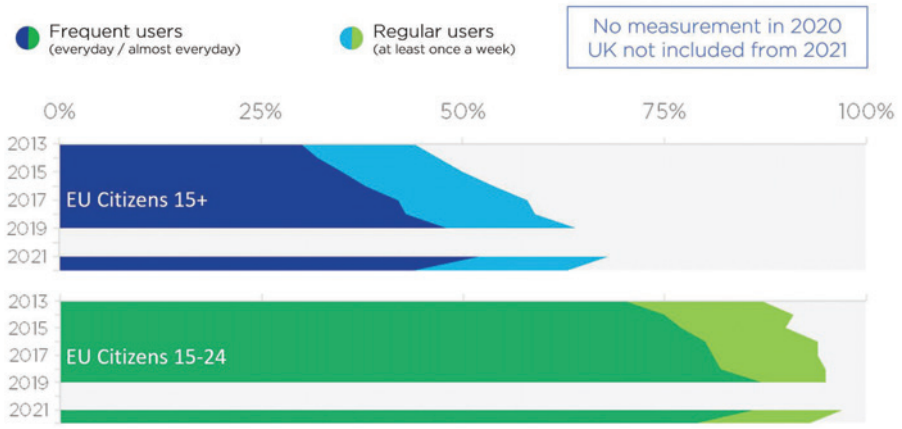


Figure 1. Frequent and regular users of social media; in %, evolution 2013–2022

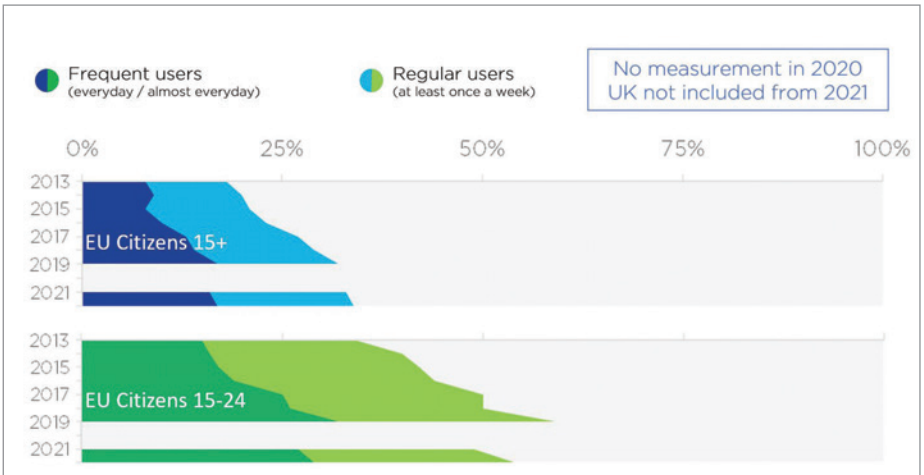


Figure 2: Frequent and regular users of television via the internet; in %, evolution 2013–2022
Source: Eurobarometer, based on EU28 (2013–2019) and EU27 (from 2021)

ONLINE TELEVISION STABLE

Overall, the number of regular users of online television continues to increase in 2022 (Fig. 2). However, the increase is less significant than in the past years, growing by only 3% so far in 2022 to reach 34% of individuals aged 15+ watching television via the internet at least once a week.

Surprisingly, among young people, frequent and regular users for television via the internet decreased between 2019 and 2021. It seems that, over that period, the proportion of regular users decreased in most EU countries (21 of 27). It might be related to the timing of the surveys (February–March) and the impact of COVID restrictions. Nonetheless, as of 2022, online television has begun to grow again but has not returned to the level of 2019. This might hint at a start of streaming fatigue.

Interestingly, watching television on a TV set remains the second most popular way for young Europeans to use media. Though, it is unclear if watching on-demand content on the TV screen via the internet is considered as "watching television on a TV set" or "watching television via the internet" or both for this tech savvy target group.

This is just one extract from the many insights in the latest EBU Digital Media Consumption Trends Report. To have a comprehensive overview of what is currently happening, the report digs deeper into smart device ownership, audio consumption and more.

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Dries Tastenhoye (VRT)
An extended masterclass presentation from this year's Network Technology Seminar

FLEXIBLE CONTROL ROOMS AT RTBF MEDIA SQUARE
Hugo Ortiz (RTBF), Frédéric Joskin (RTBF)
Designing new software-based production facilities

ARTE'S JOURNEY INTO OPEN SOURCE
Kemal Görgülü (Arte)
Introducing the French-German broadcaster's new online player

EUROVISION SONG CONTEST 5G BROADCAST TRIALS 2022
Gino Alberico (Rai)
Overview of trials run in parallel to the event in Turin

ESTIMATING TAGGING ACCURACY AT THE BBC
Tatjana Mladenovic (BBC)
Part of a metadata quality project for tagging systems

IN THE SPOTLIGHT

Ziad Elmakahleh

Chief Engineer, Jordan Radio and Television Corporation (JRTV)

Ziad Elmakahleh (JRTV) was elected to the EBU Technical Committee in June 2022

WHAT ARE YOUR CURRENT RESPONSIBILITIES?
In addition to being head of the television broadcasting department, and thus responsible for our DVB-T2 network, I oversee all of JRTV's technical support contracts with third-party suppliers. I am also leading a technical committee established by our Director General following a request from Jordan's Prime Minister: the committee is developing a set of recommendations to address problems with some technical bids. Finally, I am the official interface with Jordan's Telecommunications Regulatory Commission (TRC), responsible for applying for new or renewed licences for JRTV.

WHAT DO YOU CONSIDER AS YOUR FINEST ACHIEVEMENT SO FAR IN YOUR CAREER?
In 2017, I was the project manager for Jordan's transition from analogue to digital terrestrial broadcasting. We successfully introduced DVB-T and DVB-T2 HDTV services for JRTV.

WHAT ARE YOUR PREDICTIONS FOR MEDIA TECHNOLOGY IN THE FUTURE?
Technological progress will continue in the media industry, especially with the spread of 5G networks and systems. This will drive the creation of new media experiences and higher quality content. Falling costs will also lead to greater reach for existing technologies including OTT, digital terrestrial television (DVB-T2) and digital radio based on DAB+.

WHAT, FOR YOU, ARE THE BIGGEST CHALLENGES FOR EBU MEMBERS TODAY?
In my opinion, the biggest challenge for the European Broadcasting Union and its Members is to maintain the UHF frequencies allocated for television and radio broadcasts, 470–694 MHz. There is a lot of pressure from mobile telecommunications operators, as well as from manufacturers, to acquire 100 MHz of this band for use in other fields. I expect that this topic will continue to be a major discussion point for the EBU as we work towards the next ITU World Radiocommunication Conference (WRC-23).

TELL US ABOUT SOME OF YOUR INTERESTS AWAY FROM THE WORKPLACE.
I have a strong commitment to my family and spend as much time as possible with them. I'm also involved with various social causes that are important to me. To relax I like to play and watch tennis, and I have also travelled widely around the world, both for business and pleasure.

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