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Integrated production on the new ORF Media Campus

Plus

- **T&I Award 2023: and the nominees are...**
- **SVT's Malin Ströman on reaching young audiences**
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and more...

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AI strengthening the marriage between technology and creativity

Antonio Arcidiacono, Director of Technology & Innovation, EBU

The arrival on the 'consumer market' of generative AI tools has seen a debate that has up to this point been confined to a small group of experts now playing out in a much larger community. The kingdom of AI and data is finally crossing the audience barrier, going from a community of thousands of experts to awareness among millions of educated people.

The current situation reminds me of football fans who position themselves as their teams' trainers and strategists even though they've barely touched a football themselves for decades. People with partial knowledge of AI development over the last 20 or 30 years are taking positions; opinion leaders like Elon Musk are expressing views that often seem inspired more by personal interest than by an honest analysis of the consequences of developing ever more sophisticated tools to help or replace human beings.

AI tools are already supporting innovation and streamlining operations to free up resources for more important tasks, but is there a need to carefully 'guide' them in their evolution?

RAISING THE BASELINE
AI is going to have an impact in all human fields: powerful tools will help doctors or lawyers take better decisions; or help software developers write code, accelerating availability in an exponential self-sustaining process. The acceleration in the speed of processing has largely outpaced Moore's law in doubling every six months rather than every 18 months, opening the way to a sort of gold rush. Investors and startups are trying to surf the wave of a revolution that many promise will have long-lasting impact.

The availability of all these tools is, on one side, providing

"AI, combined with the essential contribution of trusted journalists and creatives, could open a new frontier in the dialogue between media and their audiences."

everybody with a minimum set of apparent skills – writing, coding, singing and beyond – that open great opportunities to help produce higher quality results. The basic reference level will be raised and to distinguish yourself you will be obliged to contribute original ideas and 'sing' well beyond the basic level.

At the same time, there should be rules that limit the extent to which people can overexploit these technologies to their own personal advantage, distorting information, or creating infodemic effects that could pollute the lives of individuals. Information and education are precursors of political evolution and therefore essential to preserving our freedom in democratic societies.

FEEDING THE BEAST
AI should be used to extract value from human intelligence and our critical spirit. For example, often

there is as much information in commentary from skilled readers and free thinkers as there is in the news itself – it should not be difficult to assemble and filter the best of these comments to establish the boundaries of a given subject or event. The problem with ChatGPT is that, since it is based on human-created information, if humans regress or no longer feed useful information into the system, the output will be self-referential, i.e. it will be based on AI-created content generated from information that does not evolve. If it does not have a filtering criterion and listens only to the majority, it risks a regression.

One solution to this could leverage the multiplicity of public service media, and their role as trusted third parties, to inject new constructive ideas and reject negative divergence; to expose the diversity of points of view from various countries and cultures; and to extract valuable contributions from the feedback of audiences in a sort of AI-aided media literacy exercise that could itself be facilitated by AI. The active involvement of audiences has been tried in the past and often abandoned because of limited resources. AI, combined with the essential contribution of trusted journalists and creatives, could open a new frontier in the dialogue between media and their audiences.

The new perception of AI, from the general public to the management of media companies, should be as a means of creating personalized experiences for users rather than just a way of tracking their behaviour; a way of understanding the audience better and better serving them, expecting more from an intimate marriage between technology and creativity.

EBU tech demos at the ITU

March 2023 saw delegates from around the world gathering at the International Telecommunications Union in Geneva for a meeting of the ITU-R Study Group 6. It works on a wide range of topics related to broadcasting, including vision, sound, multimedia and data services principally intended for delivery to the general public. The EBU's Technology & Innovation team took the opportunity to take the short journey down the hill to ITU headquarters to demonstrate several technologies and new ideas.

Broadcasters increasingly create content using high dynamic range (HDR), even though the vast majority of viewing still happens on displays that are only capable of showing standard dynamic

Simon Thompson (BBC) demonstrating HDR to SDR down-mapping solutions at the ITU, March 2023

range content. There is thus a need for down-mapping solutions that can convert HDR to SDR, demonstrated by the EBU in conjunction with BBC and NBC-Universal. Also related to production, the EBU showed how carbon calculators help programme makers reduce the environmental impact of content creation.

On distribution, in collaboration with Broadcast Networks Europe, there was a demonstration of 5G broadcasting middleware used in a joint project from ORS/ORF in Austria. And delegates also had a chance to see how the German DVB-I Pilot has been testing a new approach to internet-based service discovery (see page 8).

Find more information about the demonstrations, including a short video, here:
tinyurl.com/itu-demos

Working together on satellite-enhanced online delivery

The EBU is leading a consortium of companies developing an online delivery ecosystem consisting of distributed edges connected through a satellite backhaul. This approach improves playout quality and should reduce traffic costs by ingesting content as close as possible to the end user. The project is called 5G-EMERGE as it uses 5G technologies to achieve convergence.

The approach taken is transparent to the audience as their media applications are redirected in the backend to local caches on the far edge. These distributed edges can be deployed, for example, near 5G base stations, in local routers in homes or cars, or at a 5G base station on a ship. The edges can host multiple applications – running in Docker containers – that can expose edge functionalities but the project is focused on media use cases, like localization and personalization.

For content providers the ecosystem functions as a normal (multi-) CDN setup. Satellite networks, including GEO and MEO satellites, are used as a tunnel to deliver multicast streams of popular

content jumping over busy interconnection points. Content to fill this multicast feed is retrieved from reverse proxy requests in which content can be prioritized by a prefetching engine that predicts the content likely to be popular in the region covered by the satellite network.

The new approach will improve playout quality, with guaranteed low latency and fast startup times. It also works at locations that have limited or no IP coverage as it can fall back to a satellite-only mode if required. Network functions can be exposed all the way up to the 5G devices. Where there is no 5G network and device available, the far edge will be the end point. The 5G-EMERGE ecosystem is compliant with a futureproof 5G-architecture approach and can provide a full integrated fallback for non-5G components that already exist in the market.

The size of the 5G-EMERGE consortium – 21 companies and growing – is an indication that the proposed ecosystem is viable. The project is co-funded by ESA ARTES with contributions so far from six member states. A second phase, in preparation, will extend the project until the end of 2026 with new goals to get closer to industrialization.

Find the 5G-EMERGE partners on the website:
5g-emerge.com

5G-Emerge

Two different scenarios were tested: sport/news and entertainment

Getting hands-on with virtual production using LED walls

The use of LED walls to enhance studio productions will become widespread in the coming years. A recent workshop provided insights into some of the challenges and opportunities, writes **Paola Sunna** and **Frans de Jong** (EBU).

Virtual production is clearly not going to be used in every production. It requires a lot of pre-planning to work best but can then unleash powerful storytelling as well as enabling multifunctional studios. A recent EBU workshop on virtual production with LED walls provided a very good learning experience for the participants, some of whom experienced this type of set-up for the first time.

This hands-on workshop was organized by the EBU's LED Virtual Production group in collaboration with display solutions provider Leyard and supported by key industry partners[1]. Participants came from BBC (UK), BR (Germany), Rai (Italy), RTVE (Spain), SWR (Germany) and Yle (Finland).

The goal was to better understand the workflows, complexity, benefits and challenges of using LED volume walls – the term used for systems of linked high-end LED panels – for typical television programmes. Two specific scenarios were tested: news/sport and entertainment.

The first scenario was specifically designed to enable a better understanding of the use of virtual production technology, especially AR (augmented reality) elements and set extensions. It was also chosen to experiment with multi-camera operation and to evaluate the feasibility of using PTZ cameras with LED backgrounds.

The entertainment scenario tested the level of hyperrealism that can be achieved when movement or dynamic tracking is involved. In this scenario, the use of LED panels as flexible light sources was also tested.

NEW SKILL SETS
Many different skills are required to make the complex virtual production chain work. These skills are not necessarily present in a traditional broadcast environment. The presence of a technical director with knowledge of film and television production and experience with ICVFX (in-camera visual effects), 3D computer graphics applications, real-time rendering engines, etc., is a must. End-to-end training courses in virtual production, including hands-on sessions, geared to technicians, operators, producers, directors and artists are likely to be needed to upskill traditional broadcast production teams in working with LED volume walls.

Many broadcasters have studios with video walls already installed, so it's valuable to understand the cost of upgrading these existing studios, provided the dimension and pitch of the LED walls would be appropriate. Multi-cam workflows can be achieved using techniques like frame remapping and ghost framing, but additional testing is needed to better understand the implications of the different approaches.

The EBU group has a long list of areas that require further study and will continue to work on some of the following:
• LED wall requirements (e.g. for RfPs)
• Cost of upgrading studios for virtual production
• How to test LED panels
• Sustainability, especially energy consumption
• Workflows and skills needed for LED-based productions
• Practicalities of multi-cam live operation
• Lighting LED virtual productions
• Level of automation that can be achieved
• Use of LED floors and ceilings
• Combining LED and green screen technology
• Mixing LED walls with different pitch sizes

[1]. Brompton Technology, Egripment, Grass Valley, KST Moschkau, Panasonic, Zero Density

FIND OUT MORE
This event was one in a series of activities focusing on LED technology since 2021. Recordings of previous sessions, a link to join the work and more detailed findings of the workshop (EBU Members only) can be found at: *tech.ebu.ch/ledprod*

T&I Award 2023: and the nominees are…

The EBU Technology & Innovation Award, running since 2016, shines a light on some of the most creative technologists, developers and researchers from Europe's public service media community. Here we present the nominees for this year – please get in touch with us if you'd like to be put in contact with any of the project leaders to discuss a potential collaboration. **The winner of the T&I Award 2023 will be announced during the EBU Technical Assembly in Vienna on 15 June.**

New ORF newsroom for online, radio and television news

ORF, Austria • Contact: Stefan Kollinger

A fully IT- and IP-based newsroom consolidating three formerly separate teams, with more than 300 journalists producing ORF's news for all platforms since summer 2022.

Nakolos: leveraging 5G broadcast and broadband for unlimited high-quality distribution

ORF, Austria • Contact: Michael Wagenhofer

Middleware for smartphones and a cloud-based headend that enable seamless switching between 5G Broadcast and broadband, reducing CDN peaks and consumption.

AI-enriched audio storytelling

Yle, Finland • Contact: Jouni Frilander

A podcast series on urban legends that enriched the volume and variety of its storytelling through the addition of AI-generated versions of the real narrators.

Yle Novyny – Ukrainian news service

Yle, Finland • Contact: Samuli Sillanpää

Yle's first news service that relies on AI-based translations, using the EBU's EuroVOX to provide Ukranian citizens with essential information in their own language.

Automating satellite downlink configuration

Yle, Finland • Contact: Jouni Frilander

An automated solution that radically shortens the time taken to handle synopsis files used to configure thousands of satellite downlinks annually, also reducing the likelihood of errors.

SSAI: generating revenue through ad replacement on multi-channel streams

France Télévisions • Contact: Emmanuel Guilly

Using server-side ad insertion on OTT live streams, broadcast ads are replaced with paid ads from the digital advertising systems, including with accessibility features.

5G Campus Network – on the way to nomadic operation

SWR, Germany • Contact: Dominique Hoffmann

Development of a full mobile production setup using studio cameras, as well as smart production devices like smartphones, PTZ cameras and a virtual vision mixer.

InterviewTool: web-based acquisition of video and/or audio interviews

rbb, NDR, SWR, ORF and DW, Germany & Austria • Contact: Julian Hecker (rbb)

A WebRTC-based tool allowing journalists to conduct interviews over the internet anytime, anywhere, and with any device, without requiring any technical expertise.

Public cloud-based election system

RÚV, Iceland • Contact: Bragi Reynisson

A cloud-based solution providing a graphical representation of election data that the television host can control and navigate live, also available via the public website.

5G audiovisual broadcast broadband network

Rai Way, Italy • Contact: Mauro D'Onofrio

Testing the ability of 5G technologies to enable both innovative audiovisual production scenarios and hybrid 5G Broadcast/broadband linear content distribution.

User-generated AR elements for news

NPO/AVROTROS, Netherlands • Contact: John van de Molengraft

A system that allows journalists to create their own high-quality 3D augmented reality elements for on-air use, without needing to involve a graphic designer.

SeeItOver: shared data space for media content insights

RTP, Portugal • Contact: Carlos Barrocas

A system unifying data on audiences and shares, costs, revenues, advertising, etc., offering user-friendly access and enabling data-driven decisions derived from AI models.

Radio 3 takes its content to the metaverse

RTVE, Spain • Contact: David Corral

Providing concerts that can be viewed in the metaverse, in 3D with a VR headset and in 2D using an Android application, on a free-to-access platform that doesn't require registration.

Applying AI and cloud for content analysis

RTVE, Spain • Contact: Virginia Bazán-Gil

Applying automated metadata management, including the use of AI tools, to 11,000 hours of content from the RTVE archive, enabling the recovery and reuse of digitized content.

Hiperia, from RTVE

IVERES – identification, verification and response

RTVE, Spain • Contact: David Corral

A collaborative effort to combat disinformation through an open verification tool that supports the democratic state and the safeguarding of truthful information for citizens.

Hiperia: 100% AI and music

RTVE, Spain • Contact: David Corral

A character, voice and script created with various AI tools contributes to RTVE programming, enabling the exploration of cutting-edge technologies and new narratives.

AI to travel from the past to the future

RTVE, Spain • Contact: David Corral

Testing the possibilities of using AI to colourize black and white images from the archives to preserve them, improve their quality and digitize them, enabling their use in new contexts.

Elections and AI: no one without information

RTVE, Spain • Contact: David Corral

Creation of an AI-based tool that enables the automatic drafting of texts based on election results that is reliable, useful, coherent and informative.

A better and cheaper way to transcode live video online

SVT, Sweden • Contact: David Karlsson

In-house development of a solution for OTT encoding based on off-the-shelf hardware, achieving better results than leading vendors in terms of quality, scalability and costs.

Self-directed lighting system for broadcast studios and event locations

SRG SSR, Switzerland • Contact: Christoph Flüeler

A lighting automation system based on object tracking that provides lighting optimized for broadcast/video purposes dynamically and in real time.

Wing Watch from BBC

TouchViz for real-time graphics, clips and events

SRG SSR, Switzerland • Contact: Christoph Flüeler

An iPad-based system giving the host control over real-time graphics and videos in a live broadcast, with the content managed by editorial teams via a web interface.

Wing Watch – an AI-enhanced interactive wildlife stream

BBC, UK • Contact: Robert Dawes

Using AI-generated data from wildlife cameras to directly drive an enhanced 'flexible media' experience for the audience, delivering more without any extra effort.

Private 5G networks for contribution and production

BBC, UK • Contact: Ian Wagdin

Deployment of the largest private standalone 5G network to date, supporting news contribution at a large event with low-latency high-quality radio links for UHD production.

DVB-I shows promise for future television distribution in Germany

Phase 1 of the German DVB-I Pilot confirmed that the standard is a promising solution for the transition to streaming, enabling interoperable and platform-independent media access, writes **Christian Klöckner** (WDR).

The DVB-I standard aims to enable the familiar and simple use of linear television programming even when the programmes are no longer distributed exclusively via broadcasting, but increasingly also via streaming. DVB-I allows broadcast and IP distribution to be combined in a user experience that corresponds to the familiar broadcast experience and even to offer access to video-on-demand and catch-up services.

The core element of the DVB-I specification is the definition of a programme list (= service list) in which one or more different distribution variants can be specified and prioritized for each programme, making it flexible and easy to update. DVB-I is particularly suited to TV sets, but also works on pure OTT boxes/sticks or mobile devices that use internet. The DVB consortium summarizes this with the claim *Any device, any delivery, any content*.

COLLABORATIVE PILOT
The German DVB-I Pilot was designed as a joint approach involving manufacturers of TV sets and software as well as private and public media companies (see graphic). The first phase achieved two main goals: to collaborate on a futureproof television experience combining multiple broadcast and OTT sources and to gather insight for a possible launch of DVB-I services.

The aggregation of the service lists of the participating broadcast families was successfully realized and presented on the first prototype TV sets. The switchover from broadcast to IP when the devices were disconnected from the broadcast network, moderate switching times between the livestreams,

Participants of the German DVB-I Pilot

the rapid integration of services such as red-button HbbTV apps, content guides, dynamically added event channels, and next generation audio were impressive. Regionally accurate service lists were even provided, via a zip code entry on the TV set. User testing carried out by rbb found that most testers would recommend a smart TV set with DVB-I to a friend or family.

The pilot made clear the need for an organizational entity to aggregate a central service list from broadcasters' lists, to validate the lists according to the DVB-I standard, and to provide regionally accurate programme sorting for the DVB-I clients. The public value lists of the German media authorities would be suitable for the latter, fulfilling the prominence obligations introduced with the *Audiovisual Media Services Directive*. There is, however, a need for criteria for the classification of offers that are not included in the public value list.

While sign-in for digital rights management (DRM) purposes, an important feature for private content providers, was successfully demonstrated, the pilot identified additional requirements around the availability and support for DRM solutions. These requirements are

now being addressed by the DVB Project and HbbTV Association.

The availability of clients (smart TV devices and apps) is crucial for DVB-I to be successful. Currently, there is one device manufacturer with a very extensive DVB-I implementation and regular updates. Others offer partial implementations or are monitoring the pilot and implementing developments in their own R&D departments. One has indicated that its smart TV sets already available on the market could be made DVB-I-capable with an update. The next step is to expand the availability of prototype devices for broader testing of the service concepts.

With a successful first phase, broad support from the broadcasting industry, and positive national and international feedback, the pilot participants recommend a second phase to consolidate outstanding issues for a possible market launch. The phase 1 report provides the basis for this decision. In addition to the aforementioned aspects, questions of service list updating (e.g. for dynamic event channels), satellite parameters for tuning without an internet connection, new use cases and possible personalization and coverage measurement concepts are to be considered.

The Aspera vulnerability – a cautionary tale for the broadcast industry

Vulnerabilities in information systems are inevitable, which is why it's crucial to establish procedures for dealing with them quickly when they are identified, writes **Gerben Dierick** (VRT), co-chair of the EBU Media Cybersecurity group.

In October 2022, security researchers discovered a severe problem with IBM's Aspera software, a specialized file-transfer solution popular with media organizations. Attackers could trick any Aspera server into executing whatever they wanted, without even having access to an account on the system. Since these servers are very often reachable from anywhere on the internet, the flaw allowed anyone to take control of Aspera servers and use them as a stepping stone to attack the internal network of an organization.

Programming or configuration mistakes are likely to be present in almost any system, potentially causing undesired behaviour. When such a flaw allows intentional abuse, it becomes a vulnerability.

In the cybersecurity world, vulnerabilities are assigned a Common Vulnerability Exposure (CVE) ID. The Aspera vulnerability is known as CVE-2022-47986, with a severity score of 9.8 out of 10.

Any computer or smartphone user knows regular and sometimes urgent security updates are part of the game. Broadcast equipment is no exception. Preventive measures like staff training, code reviews and thorough testing will help, but vulnerabilities will still be found. Both manufacturers and users must be prepared to deal with them.

In 2022, a total of 25,000 CVEs were published. Luckily, only a small fraction of these vulnerabilities resulted in significant risk. The potential damage depends on how easy a vulnerability is to exploit, what access is granted to an attacker and how the system is used.

As with any bug, when a
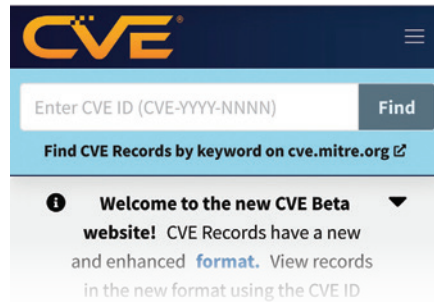
Find out more about Common Vulnerability Exposures at cve.org

vulnerability is reported to the manufacturer, a fix must be made available. But with a high-risk vulnerability, this can be very urgent, especially if the issue is publicly known. The manufacturer will also have to warn all known users of the product and inform them of the steps to take to prevent abuse.

WARNING THE USERS
When the exploit for the Aspera vulnerability was publicly disclosed, the EBU's Media Cybersecurity group (MCS) felt IBM was not doing enough to warn its customers. It proved very easy to use specialized search engines to find vulnerable systems all over the world. But the hard part was reaching the owners of those systems to warn them. Where there was a clear security-contact procedure in place, the risk was quickly averted. Without such a security contact, we had to

resort to sending a warning to a generic email address or through a contact form found on the website. Unfortunately, most of these messages were ignored. Several media organizations suffered extensive damage after malicious attackers abused the vulnerability.

Because of the potential urgency, the process of validating a reported vulnerability, assessing the risk, warning all users and expediting a fix needs to be the result of a regular, well-rehearsed and preferably at least partially automated process.

Any organizations using information systems should also be prepared. When they are warned of a serious vulnerability, assessing their exposure and implementing any fix or workaround as soon as possible should be second nature.

Clearly, this all works best if both manufacturers and customers have clearly defined cybersecurity roles and responsibilities, are well prepared, and have established direct communication channels between the right people in both organizations.

We cannot completely prevent vulnerabilities in products, which means we must be prepared to deal with them. The Aspera case shows there is still room for improvement with the vendors and media organizations.

VULNERABILITY CHECKLIST
EBU MCS recommends EBU Members and their suppliers to:
- Set up a way for anyone to report vulnerabilities to your organization and put in place a responsible disclosure policy
- Assign a cybersecurity role and put in place vulnerability management
- Assess potential suppliers on their vulnerability management procedures
- Test equipment for known vulnerabilities during development, procurement and production use

From broadcaster to platform: the ORF Media Campus and the future of media production

ORF set out its strategy towards integrating digital with linear, hybrid production and a new multimedia newsroom almost 10 years ago. Over the past 18 months, all interconnected projects were successfully finished, writes CTO **Harald Kräuter**.

Alongside the general transformation of the work environment, of media consumption patterns and towards a digital society, the core technology project for ORF, Austria's public broadcaster, has been the consolidation of different production locations on the premises of the historic TV Center. Following a thorough renovation of the legacy structure, several new buildings and extensions to existing spaces have been built and equipped with cutting-edge technology, within just five years of the initial "go" at the ORF board meeting on 22 March 2018.

Much more than a simple relocation project, the transformation included changes in workplace culture, management structure and production workflows. Additional factors within the timeframe were the transition from SDI to IP transport, from HD to UHD, from legacy IT to virtual containers and – last but not least – the COVID situation.

NEWSROOM FOR THE FUTURE
Combining previously separated units from radio, television and online in the same space, up to 400 journalists, editors and engineers can work together in the new newsroom. Delivering news content for three television channels, 12 radio channels, teletext and various websites, apps and social media platforms, the arrangement of workplaces was designed along workflows and not along traditional media boundaries. A breakthrough regarding open cooperation was made possible by situating the new fully automated television

News studio in the ORF Media Campus

studio and production gallery next to a self-service video standup position, the social media studio, the live radio booths and the video editing suites.

Within this setting, cross-media topic management and efficient exchange of information and content in case of 'breaking news events' as well as a refocus on the end-user products is possible.

ORF's technical departments were instrumental in creating not only the studio and production infrastructure, but also in tying together IT and workplace management, software and tools, and the general transformation of production and tech support in a multimedia digital-first environment, while preserving the 'heart and soul' of traditional live television and radio broadcasting.

END-TO-END CONTENT MANAGEMENT
Mirroring the mindset of the connected newsroom, a completely new environment for ingest, contribution, smart production, playout, master control and distribution has been designed and built. Centred around the concept of highly configurable dynamic workplaces, the actual workforce on the new technology floor can be scaled up from one to 36 persons, with all control and monitoring units assignable to each workplace by means of a virtual KVM and a freely assignable multiviewer solution.

The entire signal flow is run over IP using the ST 2110 set of standards for video, audio and control signals and is UHD compliant. Again obliterating traditional boundaries, the separation of playout management,

Photos: Martin Krachler

Content management centre

operational engineering and systems monitoring was lifted. Signal management and on-air monitoring of traditional broadcasting and streaming could also be combined.

Several new smaller production units close to the content management desks will allow for highly efficient smart production techniques, reflecting the need for more live and on-demand content, especially for online-only sports, news, children's and light entertainment formats.

VIDEO NEEDS THE RADIO STARS

In another "Lazy Buggles Headline" (copyright James Cridland), the relocation of the three nationwide radio channels, FM4, Ö3 and Österreich 1, from their previous offices to the new ORF Media Campus had a huge impact on the company's culture and challenged traditional television-centric producers and engineers on site. A dynamic crowd of younger, more diverse producers, presenters, creative editors and production artists, lifted the spirits and enabled closer cooperation and production.

This is well reflected in the layout of the technical setup at the new radio production spaces, which include video cameras, web streaming and live music spaces from the ground up. Built on the basis of a modular acoustic studio design developed by BOXY in Milan and using the newest audio-over-IP technology from DHD.audio, engineers, producers and talent can now switch between shows and settings much more freely, while preserving the individual character of the respective radio station.

OVERALL RESULTS

Although not without its obstacles and difficulties, the 'mega-project' of change and renewal at all levels of ORF's organization has come to a successful conclusion. Individual projects were completed on time and on budget, employee morale is high, and ratings of ORF television, radio and online products and channels are stable. As such, a major part of the transformation "from broadcaster to platform" has been achieved by the team of the Technical Directorate. From here on, it will be a combined effort of all forces inside and outside of ORF to keep this course and deliver the best public service value possible to Austria's audience.

Ö3 radio presenters Max Bauer and Gabi Hiller in one of the new radio studios

Harald Kräuter, chief technology officer for ORF

Crucial UHF spectrum at risk for EBU Members in November

EBU Members must engage now with their respective governments to prevent the loss of further UHF spectrum that is essential for both production and distribution, writes the EBU's **Elena Puigrefagut**.
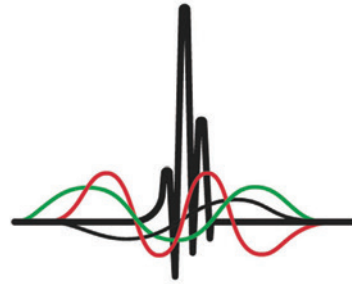
Preparations for the World Radiocommunication Conference to be held in November (WRC-23) are almost complete. The last important milestone, the second Conference Preparatory Meeting (CPM23-2), was held in April, to prepare a consolidated report on all the preparatory studies and possible solutions to the various agenda items.

DISAGREEMENTS

Discussions around one of the most controversial agenda items, 1.5 on the future use of the UHF band 470–694 MHz, were unfortunately in line with expectations regarding the search for consensus. The three years of preparatory studies exposed strong disagreements between, on one side, the proponents of the use of the band for digital terrestrial television (DTT) and wireless microphones (referred to as PMSE audio) and, on the other, those in favour of using the band for mobile services, e.g. 4G/5G.

In almost all countries in ITU Region 1 – Europe, Africa and the Middle East – the band is used by broadcasting services and this will continue in the short/medium term. Mobile services have already been allocated three bands in the same frequency range (the 900, 800 and 700 MHz bands). And even though current deficiencies in rural coverage can only be improved by further network investments, the mobile community continues to claim additional UHF spectrum is urgently needed to solve the digital divide in rural areas.

Studies on the technical feasibility of having broadcasting and mobile services share the same frequency bands confirmed that interference from DTT to mobile base stations makes such sharing almost impossible. It should be noted that these results were contested by some proponents of mobile services, who seem to conveniently ignore the findings on interference, at least for now.

The recent preparatory meeting, CPM23-2, did not manage to bring these divergent views closer. On the contrary, the number of possible solutions to satisfy this agenda item even increased, for what was already one of the most complex topics at WRC-23.

TAKE YOUR POSITIONS

In these coming final months of preparation for WRC-23, countries and in particular regional organizations, are finalizing their positions. The European group of spectrum regulators, the CEPT, has not yet defined a position. Three options are under discussion: 1) no change to the current spectrum use and review at WRC-31; 2) adding a primary allocation to the mobile service, becoming effective after 2030; and 3), as a possible compromise, a secondary allocation[1] to mobile services with a potential upgrade to primary at WRC-31.

The EU is also in the process of defining a position, which is expected to be approved by the Council of Europe by summer. The EU countries will largely influence the CEPT position, to be agreed by September.

African countries, too, are defining their positions with a large majority supporting 'no change', although the influence of the mobile community remains strong. The Middle East countries are more inclined towards using the band for mobile services as broadcasting is very limited in that region. However, a majority view has not yet been reached and the doors remain open.

It is therefore the right time for EBU Members to go to their governments, engage in the discussions and coordinate national efforts in support of the EBU's position of 'no change' in the current allocations of the 470–694 MHz band. This is essential to preserve existing DTT and PMSE use and facilitate ongoing innovation (e.g. 5G Broadcast).

Read more about the EBU position in our white paper: **tech.ebu.ch/wrc-23-white-paper**

[1] Spectrum allocation to mobile services on a secondary basis means without the right to be protected from broadcasting and with the requirement to not interfere with broadcasting. On a primary basis means having equal rights as broadcasting.

Tech trends and takeaways from Texas

The EBU's **Lucille Verbaere** travelled to Austin, Texas to attend SWSX, an annual conglomeration of parallel film, interactive media, and music festivals and conferences. Here she reports on some of the conversations of most interest for PSM.

SXSW (standing for South by Southwest, but colloquially known as "South by") was big again in 2023, with around 300,000 people attending, and hundreds of featured speakers, keynotes, concerts and film screenings, mobilizing the full city for 10 days. SXSW can claim to offer some of the world's most inspired thinkers, giving their view on topics of today and tomorrow. Among the big names in Austin this year were Ryan Gellert (CEO of Patagonia), Greg Brockman (co-founder of OpenAI), John Maeda (VP of Design & AI at Microsoft), and the futurist Amy Webb. One could choose from among a huge variety of topics, from climate change, energy, health and medtech to cybersecurity, new ways of working, startups, gender balance and of course, music, film and media.

PERSPECTIVES ON AI
As expected, the guest star was ChatGPT, scrutinized from many different perspectives. Pessimistic views argued that it will create a huge digital divide as only western countries will learn how to use it. Moreover, it will not solve the supremacy of hyperscalers (the biggest cloud providers), as they are the only ones that can afford to develop and train such tools today and regulation is too slow to react. Furthermore, democracy is at stake as any bias is greatly amplified by AI.

The optimists, on the other hand, believe AI will augment people and boost interactions around the world. What no one can deny is that AI is here to stay and will bring tremendous disruption in all industries. Consequently, media need to now think seriously about what AI will change in their sector. It will certainly create huge vulnerabilities for news providers and for any organization that relies solely on discoverability. But new opportunities are also created in the field of content creation, for example adding trust signals to content or anonymizing journalists on the field. We must work together to make it better.

CYBERSECURITY
The second big winner this year was cybersecurity. Despite massive investment – happy days for startups in cybersecurity – risks keep on increasing, especially as more sensitive data are shared, as AI empowers attackers, and there is a massive proliferation of new devices to protect. Digitalization will not happen without cybersecurity though.

Gary Kasparov (the famous chess player) called for more collaboration across and within countries and industries. We are all part of a community that can only thrive in protected environments, where human rights and trust are preserved. Data sovereignty is also a fundamental human right that should be enforced with simple and transparent tools to grant or deny accesses to our data. Furthermore, people – especially Gen Z – will not want to give their data for free anymore and will push for a fair exchange of value.

WEB 3.0 & METAVERSE
Relying on cryptography, Web 3.0 will be a key enabler for data sovereignty that does not require trust in people but increases trust in code. Web 3.0 also tightens up relationships between creators and customers to ease content discoverability and transactions, and fight against fake content and piracy.

Of course, Web 3.0 and the metaverse come as a pair. The fog is dissipating, slowly revealing a common agreement on what the metaverse is, freed from Meta's hold. For sure it is 3D-based, but gaming is just a first step with an attractive UX. The metaverse will grow into the next generation of the internet, but it needs to open up thanks to central services that ensure interoperability and trust. Avatars may be the glue, as the only logically persistent thing we need between different platforms. As an addition to stronger regulations, Web 3.0 will provide secure and decentralized asset management, that does not rely on a single organization.

Looking forward to SXSW 2024 – Keep Austin Weird!

Ground-seeding for innovation in media technology

With a long heritage but a focus firmly on the future, the EBU Media Technology Futures group brings together the R&D&I experts from around the membership. **David Wood** describes what they're working on.
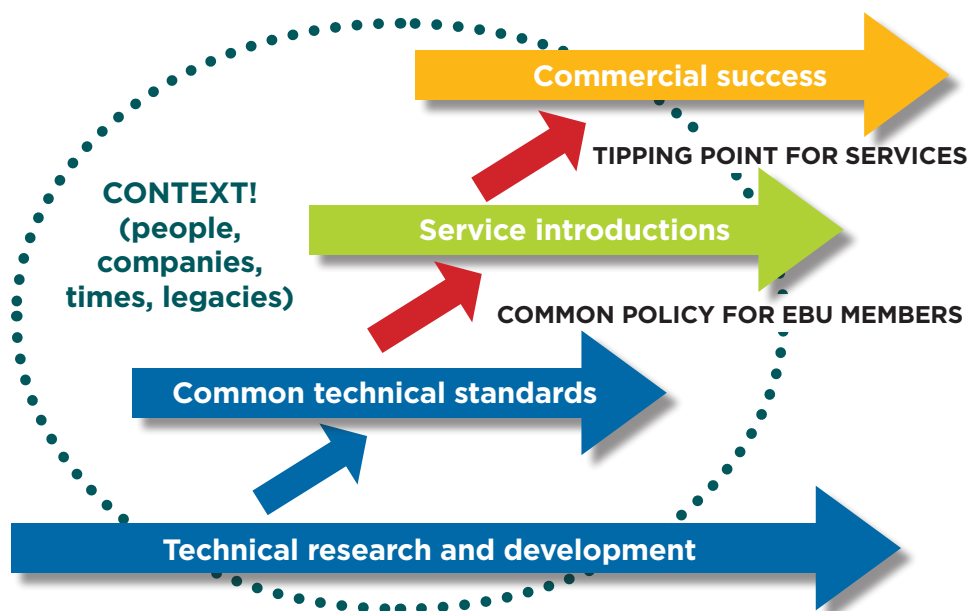
The EBU creates communities. The Technical Committee's Media Technology Futures group (MTFg) brings together a community of those who have the capacity to participate in collaborative projects in media R&D and technology innovation.

MFTg is a new name for the group, but it has a long heritage. Over the years, what was the "Heads of EBU Research" group became the Broadcast Technology Futures Group, and now, in the age where cooperation between broadcast media and online services has become the norm, it has been renamed the Media Technology Futures group.

The MTFg shares strategies and initiatives of the R&D centres of NHK STRL (Japan), BBC (UK), Rai (Italy), and several other EBU Members that have innovation units. Knowledge sharing is always on the agenda, but instigating collaborative actions and influencing decision makers is the core purpose of the MTFg. The group's task is the constant review of media technology evolution, and setting in motion consequent work that may result in new outputs – projects, tools, reports, etc. – that add value for the wider community. It sows seeds that may bring forth substantial foliage if they are successful.

Currently the MTFg is evaluating how the EBU can encourage Members to create or join innovation hubs, such as the one instigated in Belgium by VRT and RTBF, the Future Media Hub. The group also looks at ways to encourage the European Union to include relevant media technology projects in its funded programmes.

Following a successful model from Yle in Finland, the group is now setting up a test to gather new ideas for collaborative actions by using an ideation management tool called Viima. (Any Member interested in taking part should get in touch.) Another current activity involves looking into potential projects related to generative AI.

PREDICTING SUCCESS
One of the successful past endeavours of this group was a report in 2020 with an estimate of the likely changes in media technology over the next 10-20 years[1]. This has been widely cited, including by the ITU.

The MTFg is now updating and augmenting the report for 2023, preparing additional sections that would make it more valuable. The first is on what kind of information decision makers in companies would wish for when presented with a proposal for a new project. The second is an appraisal of the 'technology earthquake' – the uses and consequences of AI.

The third new section suggests alternative ways to assess the eventual success of an innovation project. One straightforward way is to weigh up the relative magnitudes of the potential benefits and the disruption.

Another is to estimate whether the means will be available to move the project from an idea to wide use, whether by the professional community or by the public. For example, the figure shown above is a simplified graphic of the stairs that need to be climbed for a new system to find success with the public.

A third indicator looks at whether the product can be successful in a given time window – whether it will be between 'too early' and 'too late'.

These are all tools for assessing only the likelihood of success. Alas, the media world is too complex to be certain of success or lack of success. Your hunch will also always be valuable.

EBU Members can join or follow the work of the MTFg here: **tech.ebu.ch/mtfg**

[1.] See: tech.ebu.ch/strategy-btf-group-report-2020

Keeping sustainability in focus for public service media

Hemini Mehta, who leads on sustainability matters at the EBU, reports on the recent EBU Sustainability Summit 2023. It was a full-day online-only event that attracted more than 500 registrations.

This year's EBU Sustainability Summit, now a firm fixture in the media and broadcast industry's sustainability calendar, was opened by Marinella Soldi, who chairs the Board of Directors at the Italian public broadcaster Rai. She placed the topic of sustainability in the wider context of the company's developing environmental, social and governance (ESG) plan. The overall drive is to move from a *compliance* perspective to one that is rather a filter for decision making and prioritization.

With direct links to the charter that governs Rai, the ESG plan aims to help define the broadcaster's actions both on and off the screen. As an example of on-screen actions, she mentioned *M'illumino di Meno*, the Italian national day of energy saving, which was woven into the storylines of soap operas on the day. She also described the companywide network of sustainability ambassadors who promote, within their own units, the ESG actions agreed with the board.

Marinella Soldi believes that the various strands of Rai's ESG plan are crucial for the future of the company. "I feel confident that it's an approach which PSM absolutely own because of the nature of their existence," she said, "and therefore we really should be making it one of the greatest competitive advantages that we have."

KEYNOTE FROM SONY
As leader of the global sustainability department at Sony Pictures Entertainment since 2009, keynote speaker John Rego introduced the company's "Road to Zero" plan. Based on the belief that sustainability is important both

Marinella Soldi, Rai

for the planet *and* the business, Sony's net-zero plan has goals for biodiversity, use of chemicals, conservation of resources, and climate impacts. When it comes to climate, there are five targets: eliminating carbon emissions, achieving sustainable production status, inspiring climate action, minimizing single-use plastics, and engaging Sony's employees (some of whom also contributed directly to the keynote presentation).

One striking goal mentioned was a commitment to achieving 100% renewable electricity by 2030. This has almost been achieved in the company's UK facilities where, for example, the soundstages at the Sony studios in Wales are now 100% powered by almost 2 MW generated by on-site solar panels. And electricity use at the Culver City facilities in California has been reduced by over a third, even with the addition of new buildings and electric charging points.

PROGRESS ON SDGS?
All sustainability strategies hinge off the United Nations Sustainable Development Goals (SDGs). The SDGs were adopted in 2015, with a target date set for 2030. We are now, thus, almost half-way there and at a good point to analyse where we are with regard to

achieving them.

Martina Donlon, Head of Climate Communications at the UN, provided an overview of current progress and what comes next for the SDGs. The recent times of wars, the COVID pandemic, economic downturn, etc., has caused progress to stall. In September 2023, the UN will hold a two-day summit with governments and business leaders to find a way to ensure the promises of the SDGs are kept.

The UN focuses on science and data. All the decisions, actions and information provided must be science-based to cut through the noise, misinformation and disinformation. Achieving the SDGs requires everyone to be more ambitious. As individuals from high-income countries, there are choices we can make through our roles as employees, employers, consumers, voters, etc. The UN wants us to tell stories about what a greener, healthier planet looks like and this is somewhere that, as broadcasters, we can have a huge impact through our content.

The presentations from the EBU Sustainability Summit 2023 are available to watch on demand via:
tech.ebu.ch/sustainability2023

Seeking strong value propositions for younger audiences

Reaching younger audiences is a top priority for Sweden's SVT. Chief product officer **Malin Ströman** stresses the importance of constantly seeking the right value proposition.

While our video-on-demand service SVT Play is popular among over 45s, younger adults in Sweden, who consume even more online video – in general they don't even have access to broadcast channels – say it's Netflix, YouTube and Instagram that drive their consumption. For teenagers, it's mainly TikTok. Still, SVT retains a strong belief in its own platforms for the future.

Though it may seem that young adults are addicted to their smartphones, and to social media, they report mostly consuming video from streaming services and YouTube, and that the majority is consumed on a TV screen – 56% compared to 25% on a mobile. For teenagers the ratio is reversed, but we've observed that these mobile-hungry teenagers, growing up and entering the world of work, have less time for their phones. They then seek a sense of community relaxing in front of the big screen in their first home of their own.

So, we use TikTok and Instagram as the most effective ways to connect with young users on their smartphones, reminding them of SVT's offer, compared to others. But we still have some things to figure out: why would these young users choose SVT Play instead of Netflix and YouTube? What can we offer that will better answer their needs?

In general, all streaming services seem to serve the desire to watch something with a partner. A high proportion of all users, all ages, mention this as one reason for watching the various platforms. SVT wants to strengthen this further to create a sense of community. Competing with TikTok and Instagram is challenging, but maybe we can come up with formulas that work.

Malin Ströman

STAY UPDATED & LEARN
YouTube seems to answer the greatest diversity of needs: scrolling through content that doesn't require anything from you, having fun, having something playing in the background, or just watching for short stretches. But also, to stay updated in areas that interest you and to learn new things. These last two are value propositions that we, as a public service company, would like to own.

Besides catching up with something missed on television (SVT1, SVT2 or our kids' channel SVT Barn), another often-mentioned reason for watching SVT Play is to stay updated! Indeed, for 15–29-year-olds this is the strongest reason to choose SVT Play. So, we're now exploring this offer further for younger users – not those who know the news shows from television, but those who need reliable news sources, knowledge and facts to make sense of the world, to participate in conversations with friends and to be able to make the best choices.

The value proposition is about always offering content to find and consume according to a certain need. We're running tests with short news content, lowering the threshold towards generating interest in longer stories. We see that it's easier to start something short and, with interest triggered, continue to learn more about the subject. This responds to the users' habits of speed, indulging in a special interest, and short attention spans.

In other experiments – with live 'slow TV', short live formats, children's formats, news video clips and more – we're exploring how interactions in the video player, with likes, chats, personal settings or just to see other parallel viewers, increase the probability of a user returning sooner and/or more frequently. A strong value proposition sees users returning at least once per week and, when it comes to being updated, preferably much more often.

These tests require rapid content production combined with development of components for navigation, exposure and interactivity. A/B testing tools are required, and analysts using the live data for insights to determine the subsequent tests. The formats transform in tempo, length and look, even sometimes for the next publication, while others may require a few weeks before being transformed to something completely different based on what we've learned.

All data provided by Ungdomsbarometern and internal research, user behaviour mapping and agile experiments.

Doing LESS to achieve more on streaming sustainability

Founded by **Dom Robinson**, Greening of Streaming already counts many of the industry's most significant operators, service providers and technology vendors among its membership.

Greening of Streaming is an industry body that acts to improve energy efficiency and sustainability efforts relating to streaming services' architecture and design, promoting power as an equally important design consideration to price and performance in system development.

Why? Well, based on conservative estimates, it's reasonably safe to assume the industry drives a demand for somewhere between 2% and 3% of global electricity. Quite staggering for an industry that most people think has only been around for a decade (although most of our members have been involved for much of streaming's actual 25–30 year history!).

As streaming engineers we realize the one thing we can directly influence to some extent is operational energy. We focus on reducing kWH or average wattage of our underlying telecoms, data-centre computing and consumer equipment through better streaming systems architecture and use of infrastructure. While we think about 'reducing carbon emissions' as a key outcome, we don't talk about it very much since in engineering terms it is badly defined and difficult to target for an industry that is focused on software services architecture. Wattage is something we understand and can directly do something about through choices in service design.

As an industry body, we want to take the bull by the horns and try to reduce that system-wide energy demand, to benefit the climate, reduce reliance on both renewables and fossil fuels as 'good energy citizens', and – equally importantly – we seek to reduce the commercial cost of operations of streaming services.

Dom Robinson, founder of Greening of Streaming

With significant international traction and many active working groups spanning all aspects of the streaming workflow, Greening of Streaming is practical and pioneering. It is not an accreditation or offsetting group: it is focused on developing real-world engineering improvements to streaming systems. It is important to note that it is NOT a standards development organization (SDO). It is a user group that seeks to work with SDOs to encourage consideration of energy efficiency as a 'first class' key performance indicator (KPI) in the development of technical standards that relate to streaming.

THE LESS ACCORD

The Low Energy Sustainable Streaming (LESS) Accord is a movement that Greening of Streaming is driving across the industry. It aims to dig deep into the heart of the broadcast and streaming industry and ask a taboo question of a quality-obsessed industry:

"What if the default streaming encoding profile was energy optimized with 'acceptable'

quality for general viewing rather than, as it is today, quality optimized (and typically overprovisioned) with no energy consideration?"

The fundamental idea is that, in many cases, consumers cannot tell the difference between various streaming and broadcast service qualities, and increasingly the industry relies on computer-aided techniques to differentiate quality that humans cannot perceive.

A key motivation behind the LESS Accord is to 'give permission' to stakeholders to ask out loud what many engineers in the industry already instinctively, privately think. We are asking them to explore how we might be able to deliver services that fulfil consumer's expectations without simply overselling imperceptible quality/value propositions and creating inappropriate, expensive, unsustainable, and unnecessary energy demands for no benefit to the viewer.

These energy demands may have environmental and economic impacts. The LESS Accord seeks to reduce those impacts. We're currently in the first stage – actively seeking input – of a five-stage plan that runs to the end of June 2024. If you have informed insights, datasets of interest, ideas, and just weird and wacky left-of-field suggestions, we want to hear them all!

The best four ideas or areas of thinking will be developed into production tests by members over this summer. We will be asking the leading proponents of the best ideas to present them at our interface with the European Parliament in June.

*See: **greeningofstreaming.org/less***

The challenge of measuring total audience in the digital age

Collecting and understanding audience data is an increasingly complex challenge for EBU Members, requiring the combination of multiple sources and specialist expertise, writes **Francesca Cimino**.

Public service media (PSM) organizations and the wider media industry continue to struggle with how to fully capture total audience. Continuous development is needed to keep pace with the audience-data demands of performance monitoring across the multitudes of media services available. The EBU Media Intelligence Service report *Measuring Total Audience* looks at how PSM are dealing with the challenge.

PROLIFERATION OF SOURCES
There are three main types of audience-data sources that PSM research and analytics colleagues must navigate to build a full cross-media audience picture. Firstly, data from the national audience-measurement systems remain the most used, as they are crucial for obtaining the competitive context in which PSM organizations operate. In many markets, these datasets are undergoing development from pure television measurement to 'total video currencies'; and for radio they are moving from pure radio measurement to 'audio currencies'.

Secondly, EBU Members have their own internal data sources for their websites, apps and video/audio-on-demand services. These help PSM organizations to leverage their understanding of their own audiences and how they deliver on their remit.

The third and most challenging set of data for PSM organizations is that of third-party platforms. This is in part because of the sheer volume and variety of data sources that need to be mapped and analysed (Fig. 1). But also,

because these sources can lack the robustness and transparency of the first two data sources. The consistency of the data, both in terms of quality and availability, continues to pose problems for PSM research and analytics colleagues.

AUTOMATION & DASHBOARDS
For PSM organizations to deliver a holistic view of how they reach

Figure 1. Non-exhaustive view of data sources for measuring total audience (Source: EBU MIS based on Members' input)

citizens with their services and content, they must consider how to integrate these numerous audience data sources into their regular reporting. For this to be feasible, some level of automation is required, along with the regular dissemination of data across the organization.

Dashboards as data visualization tools are being adopted across PSM. Combining data sources through dashboards requires not only specialist technical expertise but also significant investment in planning and rationalizing (Fig. 2). Research and analytics colleagues cannot implement these solutions alone; data strategies and projects are a collaborative effort and require the participation of all data colleagues across the company.

EBU Members can access the full Measuring Total Audience report by visiting **ebu.ch/publications** *and clicking on Research.*
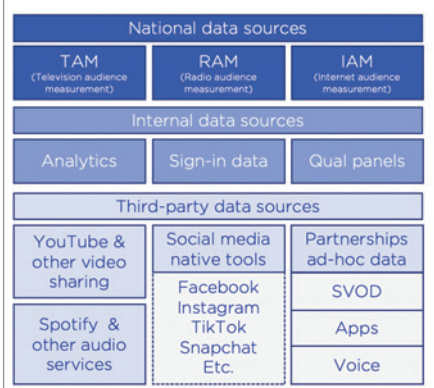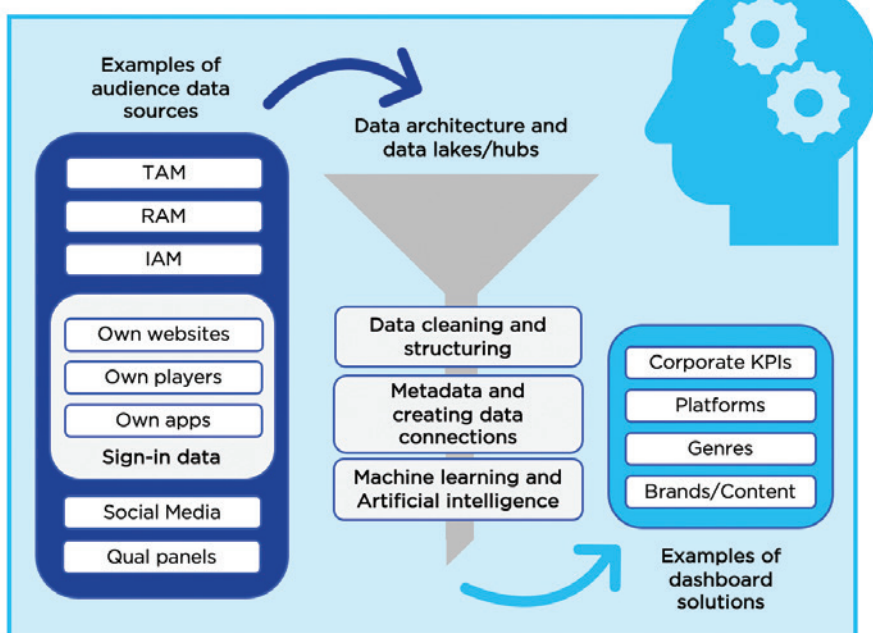

Figure 2. Simplified view of data process for creating dashboards (Source: EBU MIS based on Members' input)

IN THE SPOTLIGHT

Yioula Kyriacou

SENIOR ENGINEER AND HEAD OF DIGITAL TRANSFORMATION, CYPRUS BROADCASTING CORPORATION

WHAT ARE YOUR CURRENT RESPONSIBILITIES?

I am responsible for production and playout for radio and television, including the newsroom and the archives, as well as our IT systems. My role involves maintaining existing systems at the highest standards, as well as proposing and managing new projects. Projects I have managed include systems for production, outside broadcast vans, satellite news gathering van and satellite installations, television playout systems, television production studios, media asset management system, newsroom system, radio production and on-air system, as well as the digitization of CyBC's archives. In parallel with my work in the Technical Services, I am currently leading CyBC's digital transformation.

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

I have managed and delivered many projects at CyBC, each with its challenges along with positive experiences. I have particularly enjoyed working with teams across all CyBC's departments. Measured by their impact on society and how they contributed to CyBC's internal transformation, I consider as my finest achievements the shift of our workflows from tape to file-based, the installation and operation of our production and archives platform, and the digitization of our legacy archives.

The latter project laid the foundation for starting CyBC's shift to digital media and new ways of producing and distributing content. (See tech-*i* 52, June 2021, pages 8–9.)

Yioula Kyriacou is also the EBU Diversity, Equity & Inclusion liaison to the EBU Technical Committee

WHAT ARE YOUR PREDICTIONS FOR MEDIA TECHNOLOGY IN THE FUTURE?

With so much disruption in the media industry and the convergence of media technology with other technologies, it is hard to make predictions. I believe that platforms are the future and that media organizations will continue to collaborate with other industries to create value. AI will increasingly play its part against disinformation and in enhancing content production. Data-driven strategies will enable us to produce content that is relevant to audiences and distributed strategically. Personalization of services will be further enhanced, and I hope that accessibility services will be an integral part of all media. We will probably see a shift to visual and shared experiences in the metaverse, something that could create an online sense of community, belonging and connection. Sustainability efforts will be enhanced, and media companies will rethink the media carbon footprints, further considering cloud-based production. As convergence of media and IT systems deepens, security will, like never before, become vital in ensuring media availability and integrity.

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

We need to reinvent ourselves and find new ways to add value to society. We need to shift our mindset from linear services to online offerings and to platforms. The same goes for the way we operate and with our internal processes. I believe our biggest challenge is letting go of what we are used to and allowing ourselves and our organizations to transform. Realizing, despite our technological investments, that technology cannot transform our organizations on its own is important. It is the alignment of the social and the technical organizational subsystems that will enable us to innovate our internal processes and our services. Breaking the silos, finding synergies through multi-functional, flexible, and autonomous teams, effectively communicating, reskilling, training and managing talent, working towards making our brand stronger on third-party platforms, and focusing on our audiences, are tools towards our transformation. Reaching younger generations is another big challenge. On a technical note, dependency on vendors for software and applications, expensive service level agreements, interoperability of systems, security and continuous new knowledge and skills required, are some of our engineering teams' challenges.

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

I enjoy walking outdoors, travelling, and learning new things. I make sure that every weekend, I spend some time gardening, something that helps me clear my mind.

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

MEDIA CYBERSECURITY SEMINAR
AN EBU EVENT
SHAPING A MORE SECURE MEDIA INDUSTRY

11-12 October 2023

tech.ebu.ch/events/mcs2023

H(O)RIZONS
AN EBU EVENT
THE MEDIA DISTRIBUTION AND PLATFORM TECHNOLOGY CONFERENCE

14-15 November 2023

tech.ebu.ch/events/horizons2023

PR(O)DUCTION TECHNOLOGY SEMINAR
AN EBU EVENT
Experience is key

30 Jan – 01 Feb 2024

tech.ebu.ch/events/pts2024