tech-*i*

3. Love Story   Aflevering 1 - Bob

Elisa

[lacht]
Daar kwamen we altijd bijeen en
dan zaten we daar maar te
babbelen en uh....
[giechelt dartel/dartel
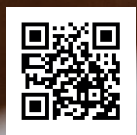giechelend]
da moet ge nu niet vragen he...

32:27   1x

Podcasts without sound?
Rethinking accessibility

Plus

• **Past EBU T&I Award winners: what happened next?**
• **Damien Corti on SRG SSR's new technology radar**
• **Measuring the real energy consumption of streaming**

and more...

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Cover story: The Dutch public media organization VPRO is developing TypeCast, a podcast player for deaf and hearing-impaired audiences. On page 8, Geert-Jan Strengholt, Creative Director with VPRO Medialab, describes how the project has evolved.

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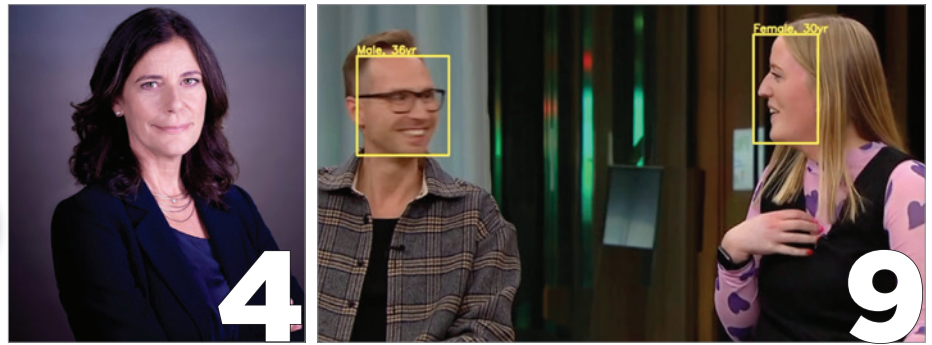
TECHNOLOGY & INNOVATION
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- We stimulate active collaboration so that you get more than innovative technology – you get a real competitive advantage.

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Contents

We must combine broadcast and broadband to deliver the future

Antonio Arcidiacono, Director of Technology & Innovation, EBU

It is not difficult, these days, to find voices that advocate accelerating towards a world without broadcast. There are many who believe, for different reasons, that we will soon be able to meet all our needs for entertainment, information and education, as well as emergency communications, via online delivery. In this world, digital terrestrial television joins the dinosaurs and satellites address only B2B datacom needs. Such a hypothesis is based on a presumption that broadcast is only good for distribution of traditional linear channels but cannot support new and future media services. Is this accurate?

At the same time, experiments with new media formats continue apace, moving towards providing more immersive experiences. The FIFA World Cup, for example, provided an opportunity to test the state of the art in free-viewpoint video, sometimes called "freeview" or volumetric video, a new pillar of the spatial media universe where public service media organizations will be expected to at least match the offer of their commercial competitors. The end user, on a 2D display, can select their point of view (and the related listening experience) freely moving in space, and backward in time, becoming the director of their own individual experience.

A free-viewpoint experience implies a set of technical realities that bring us back to the question of distribution. Volumetric video captured in a stadium can be encoded at about 2 Gbps; distributing a single point-of-view on demand will require a guaranteed bandwidth of 50–60 Mbps available to an individual user to ensure a consistent user experience. Could this kind of service be made available to millions of users at the same time and, if so, how can this be achieved?

Distribution over a large area can be envisaged using a fibre-to-the-home connection, where available, but becomes unsustainable, technically and/or financially, when using a DSL or a mobile network infrastructure. Furthermore, telecom operators, striving to be economically efficient, dimension their network for average usage and oversubscribe the network capacity. As pure unicast networks, contrary to broadcast, do not scale well for very large concurrent audiences, this is a recipe for network congestion at the time of peak demand, which is the case with popular live events.

SCALABLE SOLUTION

Solutions will most likely come from combining broadcast and broadband: satellite broadcasting can deliver the 2 Gbps live content to network edges, including homes, with collaborative unicast connectivity provided by terrestrial wireless or wired means. This will leverage the scalability of broadcast and the flexibility of unicast, resulting in a sustainable solution able to cover the entire population with a ubiquitous guaranteed quality of service. (Solutions combining satellite edgecasting and unicast infrastructures are being developed in the 5G-EMERGE project[1].)

The same content could be of interest for people locally attending live events. We have already seen how sports fans embrace a relatively low-tech experience like hearing the referee's decisions in an earpiece; imagine the excitement for a fan who can select their own viewing angle regardless of where they are seated in the stadium.

Again here, the combination of a broadcast and unicast solution exploiting a local wireless broadcast signal would be technically and economically efficient, leveraging the implementation of 5G broadcast/multicast technologies at higher frequencies in a relatively small area.

This is also a tangible example of blending physical and digital worlds in what we can call a *phygital* experience: the social element goes hand in hand with the augmented digital reality, using technology to connect the digital and physical worlds.

Enabling and cultivating shared experiences while providing for individual needs is a key task of PSM. Shared experience is based on common elements experienced by everybody and individual elements that are unique to each person. New media formats will necessarily need to include both the common and the personalized components.

For too long broadcasting and online have been considered in opposition, and not complementary. The option of combining broadcasting and online must be kept to the fore; we must use both broadcast and online technologies in a sustainable and smart way to ensure that PSM organizations keep control over future distribution in their own hands.

1. 5g-emerge.com

Put sustainability on your April agenda

The **EBU Sustainability Summit** returns on **Tuesday 4 April**, providing an opportunity for the media community to share experiences and best practices around sustainability measures. It's an online event and attendance is free for EBU Members and non-members alike.

The opening keynote will come from Marinella Soldi, who chairs the Board of Directors at the Italian public broadcaster Rai. She will talk about why and how sustainability has become a priority for the organization.

There are three main topics on the agenda for this year's Summit:

- COVID and the energy crisis – where does the broadcast industry find itself after the successive shocks of the past few years? Is there really a "new normal" or are things returning to business as usual?
- Travel and production impacts – how can the latest innovations in transport and haulage, materials, virtual production techniques, and travel policies help reduce the ecological footprint of making programmes?

Marinella Soldi, Chair of the Board of Directors at Rai, keynote speaker for the EBU Sustainability Summit

- Green streaming – what does the growth of streaming mean in terms of energy use and carbon footprint? What are the implications for broadcast organizations and how can we work towards more responsible practices?

For the full programme and to register, visit: tech.ebu.ch/sustainability2023

New approach for NTS 2023

Our ever-popular Network Technology Seminar is innovating with a new, highly interactive format for 2023. While the first day of the conference will offer the usual high-quality programme of keynotes and technology updates, the second day will be run as an **unconference**. Attendees will build the agenda together that morning, thus guaranteeing a day focused on the most relevant and pressing topics.
See: tech.ebu.ch/nts2023

EBU seminar on data technology, metadata, AI and more

Running from 21 to 23 March, EBU DataTech gives a very good cross-section of what media organizations and the wider data industry are doing and thinking around data and AI – what's being built and used, where, how and why. It's also a great opportunity to hear directly from and discuss with the makers.

Building on the long-standing success of its forerunner, the MDN Workshop, this year's DataTech Seminar programme will feature 42 presentations, with more than half from EBU Members, and six demonstrations.

The programme is aimed at those working in the field of data and AI at different levels, from management to project development and architecture.

Sessions will focus on on data strategy and governance and data-driven success, including presentations from Chief Data Officers at public service media organizations. There will also be sessions dedicated to the use of AI and semantic technologies to get more value from content and archives. Leveraging data and AI to reach the audience will be another key topic.
See: tech.ebu.ch/datatech2023

Considering the cloud for media production?

A strategic report published late last year will be of use to any EBU Member considering the step of shifting production resources to the cloud.

In an accessible way, it covers the many strategic, technical, and behavioural considerations the come into play: the standard APIs, vocabularies and visual language, the interoperability caveats, security and sustainability, financial predictability, and emerging DevSecOps practices.

See:
tech.ebu.ch/cloud-report2022

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STRATEGIC OVERVIEW OF
CLOUD-BASED PRODUCTION TECHNOLOGIES
FOR PUBLIC SERVICE MEDIA

OCTOBER 2022

New course for young media professionals

A new course from the EBU Academy is designed to help young professionals at EBU Members take their career to the next level, equipping them to participate in peer networks more effectively and with confidence. It is offered from 5 to 8 June as an e-Master Class.

The course will give participants the tools they need to develop their personal brand and raise their international profile. Perhaps someone at your organization could benefit from this?

One important focus will be on strengthening public speaking, moderation and networking skills, a prerequisite to becoming a confident representative in expert groups, communities of practice and collaborative development initiatives.

There will also be an opportunity for participants to develop their professional network, discuss professional

Skill up, speak out
and raise your international profile

challenges with peers and become an active contributor to the work of EBU Technology & Innovation.

Enrol now via tinyurl.com/raise-profile – or contact Hélène Rauby-Matta (raubymatta@ebu.ch) for more information.

Snapshots of the EBU Production Technology Seminar 2023

(Clockwise from top left): Marijke Wouters of Venly (right), one of several media startups introduced by Clélia Twagirayesu of VRT Innovation; Wesa Aapro of Yle talked about the exciting potential of platforms like Roblox; the conference lobby buzzed with discussion in the regular networking breaks; BR's Danilo Pejakovic explained how synthetic humans and deep fakes can change the game for media; several technology demos showcased the latest developments in production and display. *For more photos and to view the presentations, visit: tech.ebu.ch/pts2023*

A new sports streaming platform from the EBU

Eurovision Sport is innovating to create Europe's best destination for digital sport consumption, leveraging its impressive rights portfolio and the unparalleled reach and position of EBU Members. **Jean-Baptiste Casta** makes the pitch.

For sports of all kinds, the ideal situation is to be exposed to the widest possible audience while simultaneously maximizing the income from selling media rights. Sports federations that sell their rights to a premium subscription platform may fetch a higher price but, as many sports have found, their potential audience is much smaller. According to Ampere Analysis nearly two-thirds of sports fans do not have access to premium channels or services.

Unable to find a premium buyer, some federations have chosen the route of creating their own direct-to-consumer subscription-based platform but the audiences are even smaller there. And this approach only serves to increase further the fragmentation in digital platforms. It all adds up to a very poor consumer experience.

THE EBU ADVANTAGE
Eurovision Sport acquires sports media rights on behalf of and for the benefit of EBU Members. We work with key international federations across the full range of sports. It's easy to understand why they work with us: public service media (PSM) in Europe offer unparalleled capacity through their video and audio platforms. And for television alone, EBU Members reach an audience of more than 800 million people in Europe – that's more than double the size of the US market.

Having trusted and often long-term agreements in place for sports like athletics, gymnastics, swimming, cycling and skiing means that we can explore new approaches that build on the latest technologies and follow market trends. One big media trend right now is the shift towards *free*. Even the most
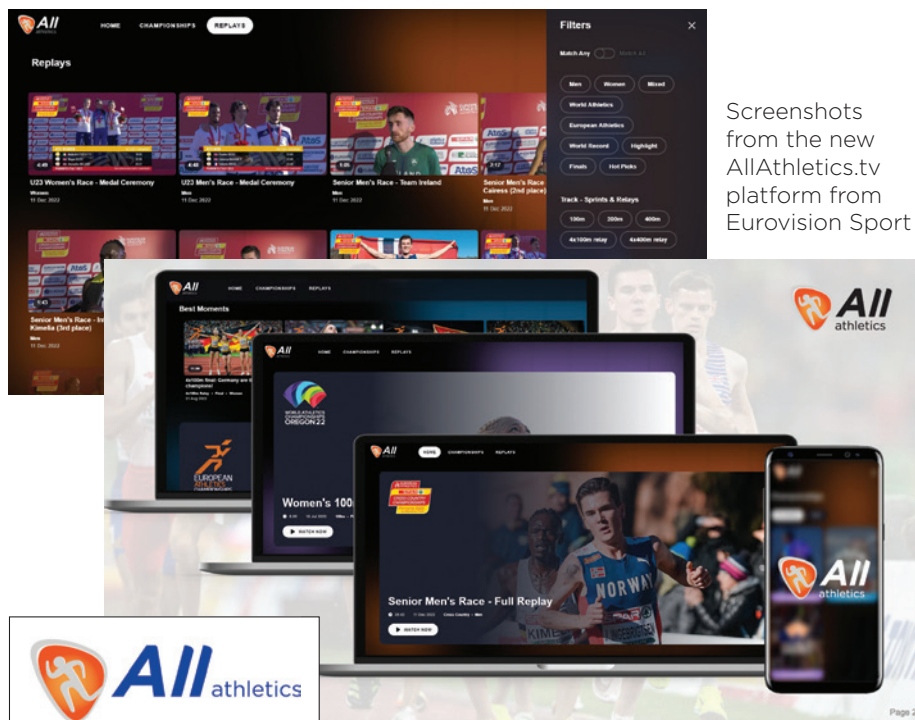
Screenshots from the new AllAthletics.tv platform from Eurovision Sport

successful of the subscription platforms are deploying free ad-supported versions, as consumers show less willingness or ability to pay. And *free* is where PSM come into their own.

We see a clear opportunity for the public broadcasters to join forces and deliver something new and innovative around sports. We want to aggregate the strength of our Members, often leaders in their own markets, and deliver a pan-European collective digital sports platform, complementary to our Members' exploitation. Having acquired such an impressive portfolio of sports rights on their behalf, we want to make sure that together with our Members, every second of those sports is broadcast.

FREE SPORTS PLATFORM
Our vision is to create what will become the best destination for digital sports consumption across Europe, aggregating all content, harnessing and complementing the power of PSM brands, values and reach, to offer free access to sport to the widest audience. Thanks to EBU Members, we have both the marketing and the audience.

We're developing a model where, depending on whether or not a given Member has the media rights to a given sport in their own territory, and the extent to which they are covering the action on their own platforms, either we will push viewers to their platforms, or they will promote our Europe-wide platform. This cross-promotion will lead to a win-win-win situation, for our Members, for the sports federations and, above all, for sport fans.

We've already launched a beta version platform, available via AllAthletics.tv. We have more launches in the pipeline, targeting aquatic sports, gymnastics, winter sports and multi-sports events, such as the European Games 2023.

Automated music detection and reporting through audio fingerprinting

In 2021, France Médias Monde decided to innovate with a view to automating its copyright declarations. **Jon Stark**, computer engineer and development manager for copyright automation, describes how the project unfolded.

Manual copyright declarations for music are time consuming for those undertaking the task and the results are often inaccurate. There are difficulties too for the authors' rights societies, related to half-yearly deliveries, non-compliant formats, lack of metadata, etc.

Over several years, algorithmic companies specializing in music recognition have emerged, but their collaborations with the various media providers are often fragmented and limited. France Médias Monde (FMM) has carried out real research and innovation work on this subject, even having a staff member dedicated to addressing the challenge.

USING FINGERPRINTING

The implementation of audio fingerprinting within the company started from scratch. As the technology is based on Shazam-type music recognition, it was necessary to test the various solutions of companies specializing in fingerprinting to identify the most relevant and robust. A trusting relationship would be essential to the good running of the project.

A precise and detailed technical survey was carried out to understand how music is produced, used, broadcast, and declared. It was also necessary to identify the most relevant metadata and the requirements of the authors' rights societies.

After several phases of testing and correction, the technology has made it possible to detect

Jon Stark presented FMM's audio fingerprinting work at EBU Horizons 2022, along with his colleagues Marion Bellahsen and Stéphane Poulin; see tech.ebu.ch/horizons2022

more elements, particularly background music. We were able to obtain more than 90% music recognition on MCD and France 24 (see box).

AUTOMATED DECLARATIONS

Once fingerprinting was implemented, the declarations for the four language variations of France 24 were automated. These declarations contain all the essential data related to the music broadcast (title, authors, duration, date, ISRC) as well as other information such as programme names or the music type, allowing its contextualization.

These statements were enthusiastically welcomed by SACEM (the French copyright management society), which now automatically receives accurate data every month. This

process allows for better payment of music royalties. In general, the use of this technology allows real productivity gains for all the production and management teams of individual channels.

The main limitation of this technology is for live performances in programmes. It is only possible to identify such live broadcasts after the event, once the extract concerned has been manually tagged in the database.

ADDITIONAL DATA

Fingerprinting makes it possible to extract a large amount of music data from the reports for the calculation of the proportion of on-air time where music is used. We can specify the nature of the music data (e.g., proportion of music idents, ranking of the most-played music, by period).

By extending the fingerprinting, we can also provide RFI's advertising department and our advertisers with real, time-stamped reports on the broadcast of their spots on our stations. In addition, this data allows us to automatically calculate the proportion of the type of advertising broadcast (sponsorships, station promos, advertising) on our channels to verify that quotas agreed with the French regulatory authority are respected.

Future plans include extending the technology to automated declaration of news reports and other spoken content broadcast on RFI. Finally, FMM programmes published on third-party platforms (podcasts, YouTube videos, etc.) may eventually be covered by the automatic declaration.

France Médias Monde, a Member of the EBU, is the French public international media group that includes RFI (Radio France Internationale – worldwide radio in 16 languages), MCD (Monte Carlo Doualiya – generalist radio in Arabic) and France 24 (24-hour television news channel broadcast in French, English, Spanish and Arabic). See: francemediasmonde.com

Podcasts without sound? Rethinking accessibility at VPRO

The Dutch public media organization VPRO is developing TypeCast, a podcast player for deaf and hearing-impaired audiences. **Geert-Jan Strengholt**, Creative Director with VPRO Medialab, describes how the project has evolved.

In the Netherlands, approximately 1.5 million people are hard of hearing or deaf. As such, this audience has limited or no access to the growing volume of public and commercial podcasts. This means that they miss out on the valuable information and the rich world of stories uniquely offered by podcasts.

During a VPRO Medialab hackathon on augmented podcasts, inspired by BBC's Ian Forrester and his notion of adaptive podcasts, we asked ourselves how we could make podcasts accessible for a deaf or hearing-impaired audience while retaining their unique quality in format, dialogue and atmosphere in storytelling. As our prime motive consisted of making existing podcasts or podcasts in production accessible, rather than developing a whole new format for this audience, we decided to build upon an existing script or transcript. Based on the prototype of the hackathon, provisionally entitled DoofPod, we conducted interviews with users from various target audiences.

PROTOTYPE PLAYER
The current prototype of TypeCast 'plays' a textual transcript of the original podcast, by presenting – or typecasting – lines of text. This transcript is 'tagged' in order to recognize voices/speakers, voiceovers, settings/contexts and ambience. The flow of text emulates the flow of sound and the development of the story experience.

The transcript is augmented by closed captions, specifically written to capture atmospherics and moods generally conveyed
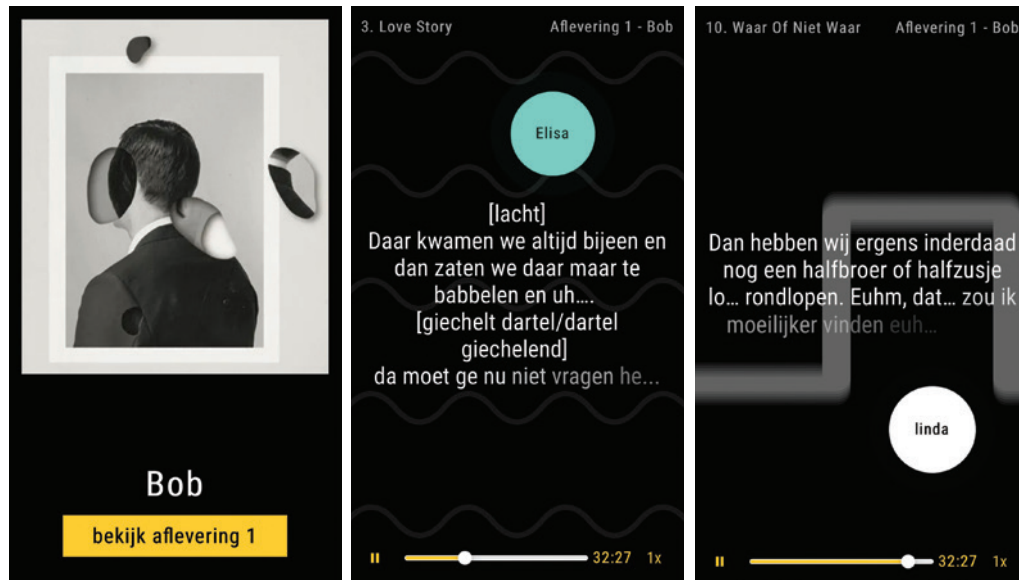
The TypeCast player plays a textual transcript of the original podcast

by sound designs. Here the explorations of artist Christine Sun Kim were a source of inspiration. Special care is taken to avoid the use of words that refer to sound qualities that a deaf audience would not know or understand. By way of abstract visuals the soundstage is set, presenting and denoting separate speakers within the podcast, but also the presence of background sounds. This rich script is then played by a mobile first code-player, dynamically calling on and including visual and functional assets... without the original audio track.

USER TESTING
In late 2022, the TypeCast player went through user tests within various user groups, ranging from a 'sudden or late deaf' audience (who still have Dutch as their native language versus sign language) to an audience with limited or severe loss of hearing. We aimed high by featuring one full episode of the award-winning Dutch/Belgian podcast Bob, by the audio collective SCHIK, a signature example of VPRO's rich and immersive productions.

What became immediately apparent was that the preferences of these test users pre-empted a one-size-fits-all solution. Those who were hard of hearing preferred having the audio track augmented by text, whereas people born deaf were overwhelmed by the amount of text and visuals.

Generally, the runtime of 40 minutes was experienced as too long, as TypeCast is much more 'lean forward' than an audio podcast. Currently VPRO MediaLab is exploring an object-based audio approach in order to allow the audience to customize TypeCast to their needs. An updated version for public release is expected in June 2023.

Using AI to understand diversity in content

Since 2022, the Danish public service broadcaster DR has been using an AI-based diversity tracker. For editorial teams as well as the diversity team, automated tracking releases resources and offers valuable insights, writes **Karen Lerbech**, media and diversity consultant.

Since 2017, DR has had a formulated diversity strategy focusing on content, with a diversity team implementing the strategy on both a strategic and editorial level.

Data has been an important component of the strategy since day one. As Heidi Sivebæk, Editor of Diversity at DR, says: "You can't make a change if you don't know your challenges. Data plays an important role in unfolding the blind spots and unconscious biases of editorial teams across DR, driving the change towards more diverse content."

Up until 2022, diversity data was gathered solely by the diversity team, including student assistants, through manual tracking. And while it has been a sound method, it has also been very time-consuming. It involves a lot of voluminous analyses, looking across whole genres or channels and generating a huge amount of data. But it's a race against time to finish the analyses before the data becomes outdated.

Furthermore, the diversity team at DR has realized that gathering big data samples also limits the number of analyses it's possible to conduct, which again limits the impact a diversity team of a limited size can have in a big organization like DR.

AI-BASED TRACKER

To increase the potential of tracking, gathering more data at a faster pace, DR last year decided to put an AI-based diversity tracker into use, Heidi Sivebæk says: "It allows us to use our resources differently and more efficiently."

The diversity tracker is delivered by MediaCatch, a Danish tech company.
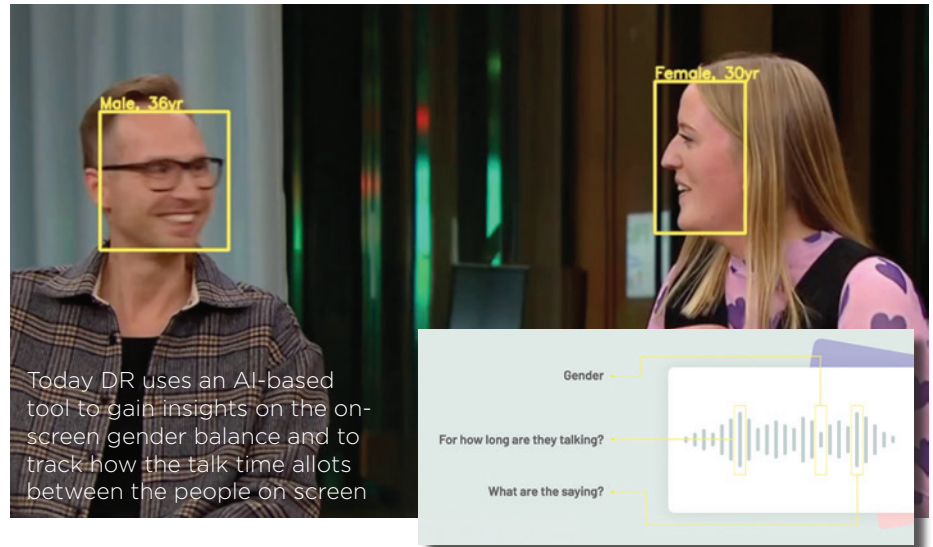
Today DR uses an AI-based tool to gain insights on the on-screen gender balance and to track how the talk time allots between the people on screen

MediaCatch builds on AI technologies that audit, for instance, live channels 24/7, using both facial and speech recognition. Where manual tracking normally counts heads, MediaCatch counts minutes on screen.

According to Lars Damgaard, CEO of MediaCatch, the diversity tracker offers a tool for editorial teams to get a deeper and more nuanced understanding of their content.

"We hope that we can help public broadcasters with insights that make them act on their diversity strategy. When we couple knowledge of gender and ethnicity on screen with who's doing the talking, how long they have been talking, and what they actually talked about, we get facts that can help you take actions," he says.

"Our insights are delivered live so editorial teams can take immediate action, because a dashboard gives them all the data they need immediately after a finished broadcast. In this way, the teams have all the insights to evaluate every segment of a programme and discuss it on a daily or weekly basis."

DATA DASHBOARDS

At DR, MediaCatch has delivered both programme- and channel-specific dashboards to ensure the information provided is as relevant as possible for the editorial teams who have access to it. These dashboards, combined with a feature that allows the diversity team to extract data from specific time slots, mean that it's now possible for them to get an overview of the gender balance on screen in, say, the evening news throughout a full year with just a few clicks.

"AI has proven very useful to us. Of course, it also has its limits as there are some categories it cannot track, for instance disabilities, just as it cannot monitor more qualitative insights like stereotypical portrayals. However, we truly believe that AI has the potential to form a solid base in our work. A potential that we're just starting to see the full scale of", says Heidi Sivebæk.

In 2023, DR will continue using the diversity tracker, bringing new features into use. For example, in the coming months the team will start testing how the tracker works on ethnicity.

T&I Award: catching up with the winners

The EBU Technology & Innovation Award recognizes outstanding technical solutions developed by EBU Members. As nominations open for 2023, previous winners tell us what the award meant for them. See issue 53 of tech-*i* for a report on last year's winning project, RTVE's trials with 5G for production and distribution.

Sveriges Radio, winners of the 2021 T&I Award

2021 • Sveriges Radio
'News Values' public service algorithm
Olle Zachrison, Head of Digital News Strategy, SR
For Swedish Radio, winning the T&I Award was a rare bright spot during the dark pandemic years. The surprise of winning ahead of giants like BBC and Rai was so great we had not even dared to prepare a proper thank you speech. However, one impression stayed with us and has kept on growing ever since: we must let PSM values guide us in the development of technological solutions, like recommender systems and editorial algorithms. "A perfect example of technical ingenuity being combined with public service values, helping Sveriges Radio to better fulfil its mission", as Judy Parnall, then Chair of the EBU Technical Committee, eloquently put it.

   The award has since then opened new doors, both externally and within SR. We have engaged in fruitful dialogue with partners like Yle, BBC and BR who are also designing systems to promote the uniqueness of public service journalism, ideas that inspire us in our own iterations. One particularly interesting project is the EBU-led *A European Perspective*, where a pan-European public service algorithm is currently being explored and tested. Defining public service value for the digital age is a central challenge for all PSMs. Promoting and exchanging ideas in cross-border forums is a great starting point.

2020 (joint winners)
France TV • AI tool for political reporting
Matthieu Parmentier, Head of AI Factory, France TV
Thanks to speech-to-text, face recognition and natural language processing to extract topics and several other metadata, our 2020 prototype was able to analyse several political debates in parallel, to offer insights to our data journalists. This successful proof of concept helped our then new-born AI department to deploy its AI platform for real and start adding value. Two business units, the Media Factory – our supply chain department in charge of programme reception, processing and distribution both on linear channels and non-linear platforms

– and the News department, asked for the integration of AI tools within their workflows.

   Media-Cloud.ai is our open-source microservices platform dedicated to AI processes for media. It is now two years old and has processed 300,000 AI-based automatic workflows such as:
- Identifying opening and end credits to facilitate the 'skip credits' function on the web player
- Resyncing live subtitles to offer a perfectly accessible replay experience
- Transcribing and/or subtitling files or streams, with or without automatic translation
- Identifying chapters and optimal ad-break positions within various kinds of programmes
- Selecting, extracting and reshaping frames of a programme to deliver a representative thumbnail that follows editorial rules

RTBF • Control Room 42
Hugo Ortiz, Innovation Officer, RTBF
Winning the T&I Award was a major milestone for RTBF's Control Room 42 project, contributing to the project's concepts being selected as a basis for designing our new Media Square building's live production systems. Extensive production experiments with end users allowed us to see a path towards redefining the way live production is done. This led to the development of the Flexible Control Room (FCR) project in partnership with EVS, aiming to turn the concept into a commercial product.

   RTBF is now designing the implementation of FCR for all television, radio and digital control rooms and studios in Media Square. It will provide a more efficient and flexible way of producing live content, by creating a common unified control and automation layer. I'll leave the final word to my colleague Frédéric Joskin, project manager for Media Square: "We are excited to see the impact that FCR will have on our operations and look forward to continuing to push the boundaries of innovation in the media industry."

2019 • tpc (SRG SSR)
"UHD1" all-IP UHD Outside Broadcast vehicle
Sandro Furter, Project Manager & Adrian Hilber, Broadcast IT Expert, SRF
For five years now, SRF's UHD-1 outside broadcast truck has been an indispensable production tool. Thanks to its IP-based technology and the associated flexibility, it is mainly used for large and complex productions like the Beijing Olympics (Alpine ski races), produced on behalf of Olympic Broadcasting Services (OBS), or the Diamond League athletics meetings in Zurich. It is also used for opera productions (e.g. Bregenzer Festspiele),

where it can show its strengths in UHD/HDR and immersive audio.

In choosing an IP-based approach, SRF showed courage, opting for ST 2110 technology, which was still new at the time. Several production hours later, we can look back on many lessons that enabled SRF to optimize the technology as well as the ST 2110 architecture in other projects. Especially for orchestration and operational processes, the experiences operating the UHD-1 truck generated valuable inputs.

One challenge that became apparent in collaborating with external production resources is that the availability of IP-based (ST 2110) equipment is still low, which makes the integration of such systems or the networking of several OB trucks with each other difficult. For example, IP gateways are still used to connect SDI signals. Here we hope for higher market penetration of the technology in the future and that more broadcasters will decide in favour of ST 2110 technology.

2018 • BBC, France TV, IRT and b<>com EBU ADM Renderer (EAR)

Tom Nixon, Project R&D Engineer, BBC
We won the EBU T&I Award for building the EBU ADM Renderer (EAR), a specification for taking object-based audio and ADM (audio definition model) metadata, and turning it into loudspeaker signals that can be listened to. This was a collaborative project in the EBU, with contributions from BBC, IRT, France TV, and others.

Since then, we've continued working in this area, aiming to encourage adoption of the ADM by building open tools to work with it. First, the EAR was used as the basis for the ITU standard for ADM rendering, BS.2127, incorporating technologies and improvements from other organizations.

Working again with IRT, we developed libear, a C++ implementation of the EAR rendering algorithms that can be built into other applications. Its main use is the EAR Production Suite, which enables authoring of ADM content in the REAPER audio workstation, using the EAR for monitoring. This was extended last year with binaural monitoring and development continues.

Finally, we have just released the EBU ADM Toolbox, a set of tools for processing ADM files in various ways – things like validation, profile conversion and, of course, rendering.

2017 • Sveriges Radio • NXG Project

Johan Sjödahl, Product Manager for Internal Radio Production Systems, SR
The NXG innovation project explored new production workflows and IP-based technology for local radio production. The outcome was highly successful from production and technology perspectives, winning the T&I Award and attracting a lot of attention within the media industry. The combination of audio-over-IP technology and simplified ways of working for self-operators was a key enabler for achieving the project goals. Lessons learned provided us with the prerequisites for future development. The major challenge, besides the obvious need for big investments, is equipping staff with cross-functional skillsets from broadcast engineering and IT.

Currently we are replacing all radio broadcasting systems, not just for local, self-operated radio production. End-user control and mobility are central to the vision for the new system. The user interfaces will be intuitive and self-explanatory, allowing the end user to manage and control both the audio flows and where the broadcast is to be distributed. Software developed in-house, combined with commercial hardware/software offerings, provides new opportunities in our technical infrastructure: robustness and stability where needed, and the flexibility, mobility and scalability that IP-based solutions can provide. Put simply: Audio ♥ IT

2016 • VRT Sandbox • LiveIP Studio

Willem Vermost, Head of Media Production Facilities, VRT
What happened after winning the EBU T&I Award? VRT was certainly well prepared to start designing the technological base of its new facilities in Brussels based on Live-IP. Time was taken to look at all the other challenges, including new workflows, to name one. Meanwhile, SMPTE ST 2110 was standardized and the first generation of IP-based studios and OB trucks became operational.

When it turned out that the realization of our building had to be postponed, we changed tack again. Delaying the new broadcast building highlighted an impending problem, that the current infrastructure was wearing out. The issue of how to bridge the next five years was turned into a learning opportunity for both the technology and the operations departments. To achieve a new level of operational efficiency, software-based production seems to be the direction to take to create a production environment that is flexible, scalable, and shareable for both recurring and one-off productions at VRT.

T&I Awards 2023 – nominations are open!
Has your organization created an innovative technology solution that could have a lasting impact on PSM? Do you know recent graduates in your organization or students who have been working on novel technology solutions relevant to PSM? Submit your nominations for the **Technology & Innovation Award** and the **Young Technology Talent of the Year Award** by 28 April. See: tech.ebu.ch/awards

Can we compare frame rates fairly?

Advanced imaging specialist **Pierre (Pete) Routhier** explains why care must be taken when assessing the effectiveness of frame-rate conversion techniques.

During the past decade, the need for test footage has increased exponentially. High frame rate, increased spatial resolution, high dynamic range and wide colour gamut, to name a few, require a significant amount of conversion to bring different sources to the same mastering format.

For example, it is not unusual for a major documentary project to integrate footage captured at 23.976, 24, 25, 29.97, 50 and 59.94 fps. This, naturally, means that temporal interpolation and/or extrapolation is required to harmonize the final product. In other words, frames need to be created, removed or modified in the image sequence to meet the number of images per second that the project dictates.

TWO SOLUTIONS
When assessing the effectiveness of frame rate conversion software and hardware, for example, it is preferable to provide expert viewers with identical motion and framing in side-by-side sequences, in order to prevent bias due to differing shooting conditions. This can be achieved in two different ways.

When comparing only two different settings (e.g. normal and high frame rates), we have used side-by-side stereo rigs with camera synchronization (Figure 1); there is a slight difference in parallax (3D views are slightly different between left and right), but as long as the subject is further than 3-5 metres from the cameras, the shots will look identical to the viewer.

This method is ideal for capturing high-motion shots with a significant amount of camera movement, and has demonstrated, for example, that high frame rate HD (1920x1080) for sports yields a superior image to UHD (3840x2160) at conventional frame rates[1].

In the case of our documentary example, we need a lot more options than two, however. As it is not practical to rig half a dozen cameras together, the method we use to create identical sequences is to generate repeatable motion and lighting in front of the camera while keeping the camera itself still (Figure 2).

FILTERS NEEDED
The main challenge in both versions (two-camera one shot and single-camera multiple shots) is that different frame rates have different integration time (i.e. shutter speeds), meaning that there is not an even amount of photons (light particles) reaching the sensor. Adjusting camera gain or changing the iris on the lens would give us a compromised signal or a different depth of field (blur in the background), which is not ideal; so instead, we set lighting and lens settings to be properly exposed for the most demanding conditions (the fastest shutter speed), keep them locked and compensate for the increased light in slower shutter speeds with neutral density (ND) filters, which reduce the amount of light incoming without changing the colour of the shot.

Ideally, the use of a variable ND filter is recommended, as it allows for an exact light match using a waveform monitor. Unfortunately, those are not always available, so when a set of fixed-value ND filters is used, there will be a need to slightly adjust exposure in post-production in order to match light levels.

In a future article, we will discuss the use of such a multiple frame rate test sequence in a practical application with a major broadcaster.

EBU members interested in procuring comparative test images can reach the author at pierre.routhier@ digitaltroublemaker.com.

1 See SMPTE Motion Imaging Journal, January 2014

Figure 1. Twin-camera setup for comparative frame rates; notice the use of matte boxes fitted with neutral density filters to compensate exposure; Figure 2. Single-camera setup with repeatable motion

Eurovision Flow: stopping at the top

Six years after its inception, and with a successful legacy under its belt, the EBU has decided to retire the Eurovision Flow multi-CDN service offering. **Bram Tullemans** explains why.

Eurovision Flow began as an R&D effort, demonstrating the technical feasibility of a new business concept. It went on to deliver significant cost savings to participating organizations and influence the market to the benefit of the entire EBU membership. With the R&D gains made, and several cost-effective multi-CDN service options now commercially available, Flow has fulfilled its mission.

The idea of the Flow project was to combine procured CDN capacity and multi-CDN technology in a single operational service. An outcome the EBU's Vision 2020 strategic plan, the intention was to help EBU Members in the OTT domain. It was recognized that PSM organizations would increasingly find audiences online, which posed technical and operational challenges with implications for distribution costs. These risks were mitigated by the Flow project by giving Members access to a state-of-the-art technology stack in a fully operational service, while reducing their cost per GB delivered.

NEW CDN TRENDS

Although it's still a technical challenge to deliver media to the masses over the internet, EBU Members' specialist teams have risen to the challenge. About half of the EBU membership now run a multi-CDN service either combining their own CDN with a public one or load-balancing traffic over public networks. The remainder of Members use a single public CDN or a local telecom operator with CDN backhaul capacity to deliver their content. This is less of a risk nowadays because public CDNs perform better, and when needed it is easier to change a CDN supplier.

When the Flow project started, CDNs suffered more operational blackouts and/or regional blind spots that could be overcome only by switching content automatically away from underperforming instances. This is where Eurovision Flow excelled. At one stage, the Flow service had eight CDNs with different capabilities in its portfolio.

Experience gained via the trial phase showed it worked best to use a maximum of three to four CDNs per content provider, with one as the core worldwide provider and adding two with regional and/or technical advantages. Having the EBU run the operation saved participating Members quite a heavy administrative and organizational burden.

FALLING COSTS

Another positive development for content providers is the reduction in cost per GB delivered now offered by CDNs. When Eurovision Flow started, the price a smaller Member had to pay was more than 10 cents per GB for a single CDN. Today prices are 5-10 times lower. Flow provided, right when it mattered, a competitive edge and healthy pressure on the market. We heard from Members who experienced large price drops

from CDN providers who learned they were part of Eurovision Flow. Overhead costs of running a multi-CDN operation on top of single CDNs have not dropped as much, which reduces the overall cost advantage.

Cost control is not the only advantage. Flow also made it possible to scale quickly, with a redundant setup to meet the needs of large events driving audiences to Members' online services. By stacking the interconnection capacity of different CDNs, Flow overcame even the biggest challenges. One example was the surprise success of the Croatian team reaching the final of the FIFA World Cup in 2018: Flow ensured that the many Croatians who could not be in Zagreb to see the glorious homecoming of the team could follow the event via EBU Member HRT's online service.

Eurovision Flow delivered on many promises, improving the quality of online delivery and providing operational and strategic advantages in addition to reduced costs. It grew into a full operational service delivering online media content for 16 companies. It reached its peak throughput during the FIFA World Cup 2022, Flow's final tournament, which it ended with a win.

EBU work on online distribution continues in the Broadband Distribution Architecture group, whose report 'CDN Architectures Demystified' (Tech Report 068) is available via: tech.ebu.ch/publications/tr068

How dangerous are radiofrequency systems?

An industry that relies heavily on wireless systems must pay close attention to potential impacts on human health. An EBU project group ensures Members have access to the required technical know-how, writes S-EIC vice-chair, **Robert Webber** (BBC).

Radiofrequency systems have been an integral part of the broadcast industry since its inception. In the early days those wireless systems were limited to the broadcasting of content. However, as technology has advanced in the 100 or so years since, wireless technologies have also become an increasingly important part of content creation.

In the late 1980s, as mobile telephones began to achieve wide public acceptance, public concerns grew about risks to human health from radiofrequency transmissions. Despite many studies over the years showing little correlation between radiofrequency transmissions and adverse impacts on health, these concerns have shown little sign of abating. For example, during the COVID-19 pandemic, conspiracy theories suggested an (unfounded) link between 5G mobile deployment and the virus.

Since the early 1990s, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) has provided guidelines on levels of radiofrequency radiation deemed not to cause harm to members of the public (Public limits), and for those working with RF systems with knowledge of how to manage the risk (Occupational limits). The ICNIRP guidelines, and other local limits imposed by regulators, define levels that are judged by health professionals to minimize harm to human health. As these exposure levels are not based on any specific technology, it can be difficult for broadcasters or network operators to know how they apply to the systems they operate.

TECHNICAL REPORTS
As part of efforts to address these limitations, the EBU's Electromagnetic Interference and Compatibility (S-EIC) project group, which is part of the Spectrum strategic programme, provides advice and guidance to Members on issues related to human health and radiofrequency. For example, the S-EIC team recently produced two technical reports on radiofrequency limits and hazard assessment.

The first of these documents is EBU Technical Report 066 (TR066) *Review of the ICNIRP 2020 Guidelines for Limiting Exposure to Non-Ionizing Radiation*, which provides an overview of how guidance has changed since the first version of the ICNIRP guidance, issued in 1998, and the subsequent ICNIRP 2010 and ICNIRP 2020 versions. This report also explains the relationship between ICNIRP 2020 and the European EMF (electromagnetic fields) directive.

The second new publication is EBU Technical Report 067 (TR067) *RF Radiation Hazards Arising From Bonded Cellular ENG Equipment*. This report was produced in response to a specific question raised by an EBU Member. The report also explains the practical difficulties inherent in making measurements of radiofrequency radiation from cellular equipment. For example, the conventional way of measuring emissions from small devices is to place them in a screened test chamber; however, it is not possible to test cellular equipment in this manner as it will not transmit without first receiving a signal from a base station.

In addition to these technical reports, the EBU S-EIC group makes a significant contribution at international regulatory level. For example, Karina Beeke (Cellnex), a member of S-EIC, is the current chair of the ITU-R WP6A *Rapporteur Group on RF Hazard issues*. She is leading the revision of Report ITU-R BS.1698 *Evaluating fields from terrestrial broadcasting transmitting systems operating in any frequency band for assessing exposure to non-ionizing radiation*.

Employees of EBU Members who are interested in the issues highlighted in this article are invited to join the S-EIC group to help ensure continued compliance with regulations, and to support the protection of people and services vital for broadcasting.

To join the S-EIC group, visit: tech.ebu.ch/groups/eic
TR066 and TR067 are available from: tech.ebu.ch/publications

Jonas Stolle on Unsplash

Energy consumption in content distribution

Carbon footprint awareness now extends to all aspects of our lives, media included. Early studies on the impact of streaming delivered hugely different outcomes, often orders of magnitude apart. Recent research is more consistent, write **Ralf Neudel** and **Sebastian Siepe** (EINBLIQ.IO).

It is misleading to look only at CO_2 figures when assessing the impact of streaming. Green energy is scarce and disputed measures such as carbon offsetting[1] disguise the amount of energy actually used. Many 'net-zero' ventures use and potentially waste massive amounts of energy. We need to focus on energy figures. Soaring energy prices support this.

While estimating overall energy use is important, a recent pilot by Deutsche Welle (DW) and EINBLIQ.IO goes further, aiming to measure the individual consumption of each individual streaming session. The first stage covers DW's mobile apps and website.

A tracking library is included in the media player collecting real-time playback data for each session. This includes details such as playback duration, quality, network, CDN and client details, thus capturing every single element of the chain.

ENERGY MODEL
As of today, there is no detailed measurement of actual energy information available along the chain. Thus, a model maps collected playback data into energy information. Our model is based on research by BBC R&D, Carbon Trust and DIMPACT. Detailed real-time data is collected in the clients and used with the model to estimate the energy used for each session and for each of the delivery chain's elements. The aggregated data can be filtered and illustrated.

However, this model-based approach lacks details like live energy data from the infrastructure. This will become more relevant when taking decisions and validating them.

Only with more detailed data, we will be able to identify and optimize all elements. Individual components should not be considered in isolation: to understand if it is worth spending more energy on content encoding, we need to know the energy impact on a) the client devices and b) server storage and network. Optimization will vary across the service and content catalogue, e.g., on-demand vs. live, long-tail vs. popular content.

Distribution infrastructures such as CDN nodes need to be ready for sudden increases in demand. Peak scenarios cause the biggest headaches, while outside of peak times the infrastructure is wasting energy, mostly just idling. This leads to the effect that, when estimating energy use, sessions during peak times appear more efficient than those during average hours.
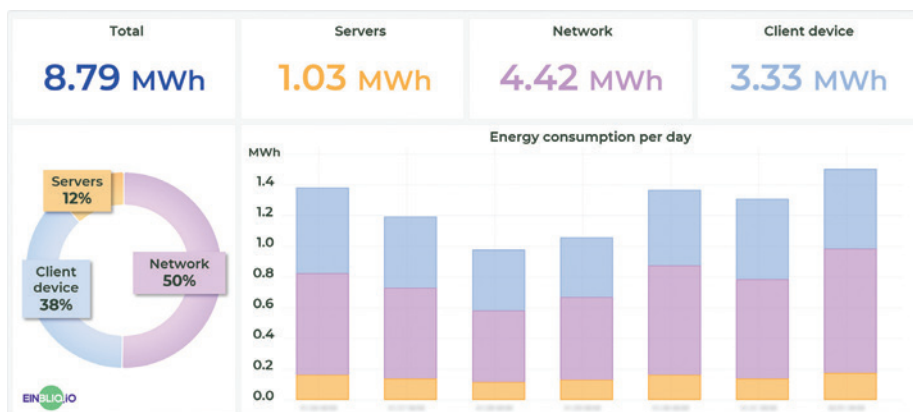
This is misleading at best: dimensioning infrastructure for peaks causes streaming to be more energy-intensive at all times. Intelligent models must attribute this fairly. Recent technology approaches like ad-hoc edge caches could cap the peak and become a game changer (currently tested by SWISS TXT, rbb and EINBLIQ.IO in 5G-MediaHUB[2]).

WHAT ABOUT BROADCAST?
Broadcast is most efficient during peaks, as there is no marginal energy use. However, the presumed shift from broadcast to streaming raises questions: what is the impact in terms of energy? Where is the energy break-even between streaming and broadcast? Will broadcasters switch (dynamically) in future? Additional data and technologies like HbbTV internet link services, DVB-I, native IP broadcasting and multicast ABR can help pave the way.

All these scenarios confirm that we require reliable, ideally real-time, energy-use data for all elements of the distribution chain – from infrastructure providers, yet also from third-party media platforms. As an industry, we need to work together – and for public service media it is an excellent opportunity to be a first mover.

1. tinyurl.com/guardian-offsetting
2. 5gmediahub.eu, an EU Horizon 2020 project

Example subset of DW streaming sessions across seven days

Scout, assess, check: three steps to smarter technology investment

SRG SSR, the EBU Member in Switzerland, is developing a technology radar to guide future investments. Hearing how other public service media organizations address this challenge is also a target, writes **Damien Corti**, Chief Technology Officer.

SRG's core business is based on the use of contemporary technologies to produce and distribute content for its customers in a channel-specific and efficient manner. However, what *contemporary* means is changing continuously and with increasing speed. This constant and accelerating change is associated with significant risks of unsound investment.

For SRG's sustainable success, it is necessary to make appropriate technology investments in a targeted manner and at the same time to avoid other technologies, again in a targeted manner. As a basis for good technology decisions, a regular, strategic technology assessment is needed. To enable this process, SRG is building a technology radar. It is structured in three basic recurring steps:

1. SCOUTING

First, it is important to scan the technology horizon continuously and as broadly as possible. The special corporate structure of SRG as a media house with four national languages and six corporate units offers opportunities here; expertise is distributed among many people throughout the company. A challenge, however, is to involve these people and motivate them to participate. Therefore, the hurdle for participation is deliberately kept low; anyone can contribute inputs. An important source of input is the SRG staff in the EBU Strategic Programmes, organized in the SRG EBU Community around the company's EBU Technical Liaison Officer (TLO).

2. STRATEGIC FIT ASSESSMENT

This is conducted at regular intervals by a working group

Damien Corti, CTO at SRG SSR

"SRG's technology radar is a work in progress and remains under construction. We would like to hear from other EBU Members. Please contact our TLO."

defined by the CTO Board. The assessment is carried out in a discussion and based on a questionnaire. To make this possible, the technology must be considered in the context of a specific application for SRG. For example, 'Artificial Intelligence' is too generic as a technology. Only in combination with the application, for example image recognition of archive material, can the concrete benefit be assessed. If a technology meets the necessary criteria, it is subjected to the reality check in the next process step. If the required criteria are not met, the inputs are either discarded or put back into the backlog.

3. BUSINESS REALITY CHECK

In the third step, the perspective on the technology is broadened. It is not only checked whether a technology is suitable for use in

SRG to improve its competitiveness, but also whether SRG is prepared for the profitable use of the respective technology. The result can be a recommendation to the management for the use of the technology, a recommendation with additional conditions (training, etc.), or a recommendation to abandon the technology for the time being.

In these three steps, the technology radar should provide an essential basis for the subsequent strategy processes and a common understanding of the benefits of the most significant technologies across SRG.

SRG's technology radar is a work in progress and remains under construction. Various challenges still need to be tackled. For example, it has become apparent that the choice of appropriate evaluation criteria is very difficult. The wrong criteria can result in misleading results. The visualization of the radar and how the process is supported through suitable tools have also not yet been fully solved. The challenge here is to prepare and make available the necessary information in a way that is appropriate for each stakeholder.

GET IN TOUCH

We would like to discuss with other EBU Members their experiences in setting up and operating their technology management. We are interested not only in the tools and processes used, but also in the challenges and lessons learned during implementation. If you are interested in a further exchange, please contact our TLO, Massimiliano Babbucci (massimiliano.babbucci@rsi.ch).

A standards body for AI-based data coding

Formed in 2020, MPAI has already published several standards targeting a diverse range of applications. Its President and Chairman of the Board, **Leonardo Chiariglione**, introduces the community and its novel approach.

Data is information converted to bits. To know what the bits mean, however, we must know the format, i.e., how information is represented or coded in bits. Data with an unknown format has little value; and data with a known format has a value that is inversely proportional to the effort required to convert it to an understandable format. Therefore, to be "the new oil of the digital economy", data should have a standard format.

The way international bodies are organized has caused the sprouting of data processing-based data coding standards, thus largely defeating the purpose of standards. MPAI – Moving Picture, Audio, and Data Coding by Artificial Intelligence – approaches data-coding standardization building on AI, thus providing a new way to manage the oil lubricating the data-coding standardization engine – patents – that only too often has instead caused it to seize up.

RIGOROUS PROCESS

MPAI standards are developed based on a rigorous process: proposals from any party are assessed for their interest, use cases identified, functional requirements documented, a Framework Licence adopted, with containing commercial requirements but without prices, dates, rates etc., and published jointly with a Call for Technologies. Anybody can respond with a declaration accepting the Framework Licence. When MPAI approves the standard, it facilitates the identification of a patent pool administrator by patent holders.

Life in the first 28 months of MPAI activity was intense. In its first year, three standards were published. *Compression and*

Leonardo Chiariglione, President, MPAI

Understanding of Financial Data (MPAI-CUI) helps predict the performance of a company for more years than with existing solutions. *Multimodal Conversation* (MPAI-MMC) enables a machine to understand a human's emotion from text, speech and facial expressions, and responds with synthetic speech and a synthetic face conveying emotion. *Governance of the MPAI Ecosystem* (MPAI-GME) outlines the MPAI ecosystem: MPAI issues standards, implementers develop specifications, the not-for profit MPAI Store receives implementations, performs conformance testing, receives performance assessments, posts implementations for end users to download, and receives experience reports.

MPAI has since gone on to publish its *AI Framework* (MPAI-AIF), providing a standard environment to execute AI applications composed of multi-sourced modules with standard interfaces; *Context-based Audio Enhancement* (MPAI-CAE), providing solutions enhancing the user experience for emotion-enhanced speech, audio recording preservation, speech restoration, and enhanced audioconference; and *Neural Network Watermarking* (MPAI-NNW), providing a methodology to assess a neural network watermarking technology.

Some MPAI standards have

been adopted without modifications by IEEE Standards Association. Three have completed the process: MPAI-MMC (3300-2022), MPAI-AIF (3301-2022) and MPAI-CAE (3302-2022). Two more are in the pipeline: MPAI-CUI and MPAI-NNW.

The MPAI groups have weekly meetings extending standards such as MPAI-AIF to configure implementation security, MPAI-MMC to cover a broader set of internal states than emotion, or MPAI-CAE to specify an audio scene. A new standard – *Avatar Representation and Animation* (MPAI-ARA) – is also being developed.

MPAI runs two video coding projects: *AI-Enhanced Video Coding* (MPAI-EVC) enhances/ replaces existing MPEG-EVC tools with AI tools and *End-to-End Video Coding* (MPAI-EEV) has already subjectively overtaken MPEG-VVC.

METAVERSE MODEL

MPAI has developed a fresh and promising new approach to metaverse standardization. It has already published the "MPAI Metaverse Model – Functionalities" Technical Report focusing on what a metaverse instance should do instead of how it should do it and is working on "MPAI Metaverse Model – Functionality Profiles" applying the notion of profiles to functionalities instead of technologies.

MPAI endeavours to exploit the benefits of AI also in health using federated learning, in online gaming to offer better and fairer games, and for XR-based venues such as for esports to facilitate their deployment.

There are many good reasons to join MPAI. To learn more, visit: http://mpai.community

The European streaming landscape continues to evolve

Video streamers are developing their offer to protect their viewer base and revenues, writes **Bob Hurt**, researcher at the EBU's Media Intelligence Service.

Streaming services face substantial challenges to their audience base and revenues, from tough economic conditions for consumers and a crowded marketplace. In response, streamers are increasingly employing mixed advertising and subscription revenue models, and offering linear streams alongside their on-demand content. For public service media (PSM), this presents both challenges and opportunities.

Streamers are attempting to attract hard-pressed consumers with cheaper/free subscription tiers. ITVX recently launched in the UK with both free advertising-funded access and a paid ad-free subscription tier. Netflix and Disney+ also added cheaper advertising-funded subscription tiers in late 2022 and became 'SAVODs' – subscription and advertising video on demand services. While cheaper streaming competitors could add further competition for PSM, the latter's 'free' BVOD (broadcaster video on demand) services also have an opportunity to further grow engagement among audiences looking for cost-effective quality viewing.

Meanwhile from a content offer perspective, FAST – free ad-supported streaming television – seems to be the word of the year. Services like Samsung TV Plus and Pluto TV have expanded across Europe, bringing a multitude of programme and genre-themed FAST channels that offer easy viewing with low barriers to entry.

FAST services face tough competition in Europe from a strong BVOD market led by PSM. But the continued appeal of linear television among some audience groups is likely to influence SVOD services, such as Netflix and Disney+, which could

begin streaming curated linear streams in the coming years. This is especially true since FAST is an ideal format for carrying advertising. Indeed, Disney+ has already experimented with live streams in the US, and ITVX launched in the UK with 18 FAST channels alongside on-demand content.

Competitors boosting their linear services clearly presents further challenges to PSM.

However, PSM's strong high-quality linear offer also means they are ideally placed to appeal to audiences who want easy viewing with low barriers to entry.

For more details on innovation in the media landscape, find the PSM Heatmap and the Hot Media Trends 2023 report by visiting ebu.ch/publications and clicking on Research.

Video-on-demand (VOD) viewing: monthly viewing among online video viewers
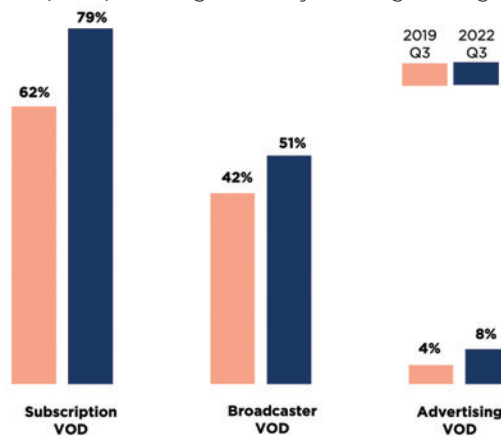
Source: EBU MIS based upon Ampere Analysis consumer survey, 12 European markets

Preferences for cheaper advertising-funded tiers in VOD services
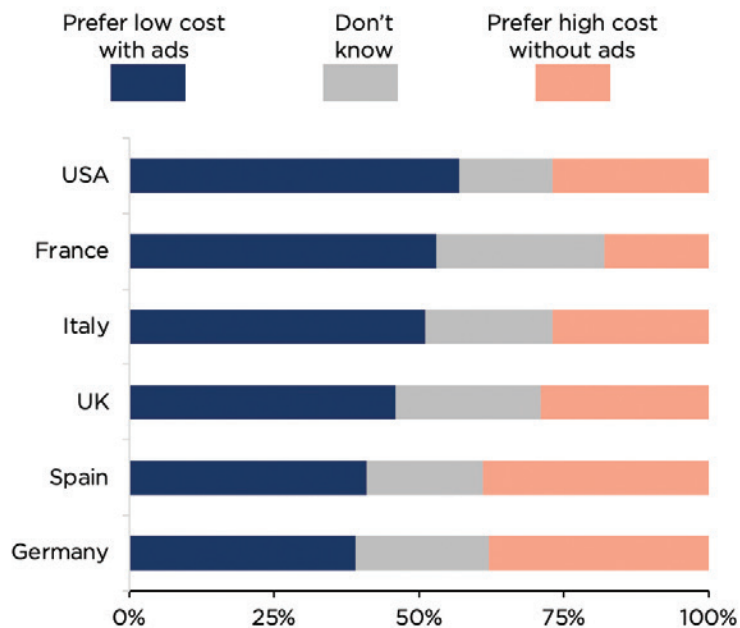
Source: EBU MIS based upon Morning Consult, survey conducted in March 2022

Simon Tuff

PRINCIPAL SOLUTIONS
LEAD, BBC TECHNOLOGY
GROUP

WHAT ARE YOUR CURRENT RESPONSIBILITIES?

I started a new role last year as a Principal Solutions Lead within the BBC's Technology Group. My responsibilities include coordinating some of our standards activity and industry collaborations. The EBU is a key part of ensuring our efforts deliver the intended benefits, so excitingly this enabled me to join the EBU Technical Committee. I'm also now playing a much larger part in our drive to develop and deploy a more sustainable approach to technology.

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

For me the best things happen when working in teams that allow you tackle bigger challenges and have a rewarding social dimension. I've worked with teams like this to launch six new digital radio stations and for the refurbishment of BBC Broadcasting House. I joined other teams to help define and implement audio loudness measurement (EBU R 128) and again to explore object-based technology with our NetMix experiment for creating custom audio mixes.

WHAT ARE YOUR PREDICTIONS FOR MEDIA TECHNOLOGY IN THE FUTURE?

We have been thinking about moving workflows to the cloud for a while now. Done well, this should offer us many benefits: the ability to adapt more rapidly; to be more flexible and to move faster; to experience better remote working; to have a lower carbon footprint. However, for this we must migrate from capital to revenue funding

Simon Tuff joined the EBU Technical Committee in 2022

models, while the technology that remains on our books and in our buildings will require new skills and probably have shorter life cycles. We need to think carefully about technology dependencies and vendor migration. As we tap into the benefits of commoditized technology, we may well find our influence over those technologies' road maps declines. As a wise colleague once observed "remember that the cloud is actually just somebody else's computer..."

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

Two stand out for me. The first is our transition to be a more complete digital media organization. Our Director General outlined this challenge well in his address to the Royal Television Society late last year. The original transcript clarifies Tim Davies' vision for our industry and is a call to action. It seems vital that broadcasters engage with renewed vigour in the collaborations that will be essential to remaining relevant, maintaining our public service

values and delivering for our audiences. The second challenge is arguably even more important: to make broadcasting truly sustainable. This may turn out to be harder than expected, as we have a habit of increasing energy and material consumption as we drive technology change. This includes the need to keep older services running for extended periods after launching new ones, the challenges of system duplication, and the need to change our habit of leaving equipment continuously powered, even though it's not in use.

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

For me it's always a delight when my personal enthusiasms and work responsibilities overlap. I love listening to the radio. At the moment, that tends to be speech radio as I'm an auditory learner, so the Reithan values of learning, being informed and being entertained have always been important to me. When you meet me you'll find I'm always keen to exchange podcast recommendations.

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