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Flocking to the cloud

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Cover story: Among the many impacts of the COVID-19 crisis, the acceleration of solutions for remote cloud-based production is one of the most striking for media. Antonio Arcidiacono outlines some of the new opportunities (page 3), while Hans Hoffmann and Ievgen Kostiukevych examine the readiness of the infrastructure (page 6). We also present the example of a Belgian project that demonstrated what can be done (page 7) and explain how the open source MCMA framework can help media get more from the cloud through microservices (page 13).

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

Design: Louise Tait

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TECHNOLOGY & INNOVATION

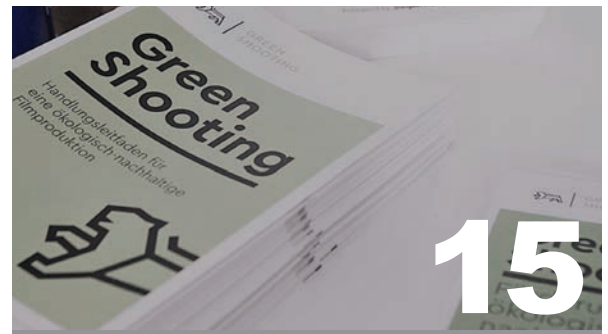
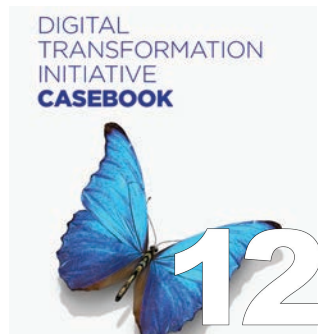
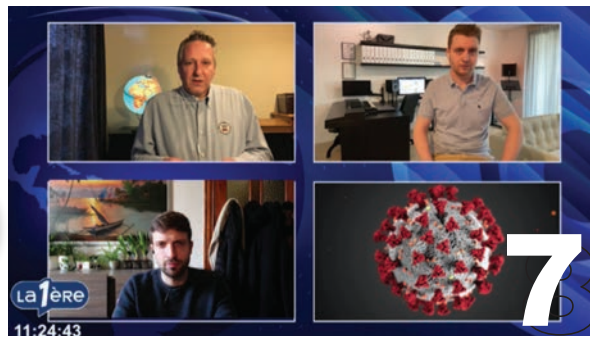
Get an edge

- Our goal is to be an incubator to advance media technology.
- We catalyse innovations so they deliver for all players
- We stimulate active collaboration so that you get more than innovative technology – you get a real competitive advantage.

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Shaping the cloud for European media needs

Antonio Arcidiacono, Director of Technology & Innovation, EBU

COVID-19 has opened a door; it is time for us to step through it and embrace the new reality, realizing the positive opportunities it brings. In short, this means acceleration towards remote and distributed production that relies on IP infrastructure and the cloud; and mature new distribution infrastructures that integrate a new generation of IP-based broadcast, multicast and edge-casting modes.

The new remote production requirements that have emerged strongly during the last few months are helping us to find new solutions, steering existing experiences in Live IP and 5G-supported production into new solutions that will become the new backbone for a cost-effective and flexible production strategy that can optimize resources. Ultimately the aim is to help Europe's public broadcasters produce, recommend and customize content with new attributes that deliver value to citizens, as curious, informed and responsible individuals.

A EUROPEAN MODEL

It is important to stress, however, that we are not going to 'copy' existing models developed by incumbent internet companies, even if dialogue with them will be a crucial part of the process (see page 6). Rather we propose an original way of serving European citizens and supporting European Media Sovereignty. AI-based language and recommendation tools will be focused on informing, educating and entertaining the 'new citizen', using a common technological base for a diverse range of applications/industries. A distributed online cloud-powered infrastructure will allow the development of new formats, interactively involving thousands of end users.

The theory, however, is all well



and good; we need to translate this into actions, and for this you need energy. My role and that of the T&I team is therefore to catalyse the resources and the expertise available in each EBU Member, proposing new ideas and related products and services, and aggregating those resources to build that innovation edge – the innovation that remains one of the goals and *raison d'être* of public service media.

The practical implementation of our vision has been already translated into a series of successful initiatives. These include the expansion of the

PEACH personalization and recommendation tools, the launch of the EuroVOX project (page 14), the creation of the 5G Media Action Group to represent the media industry in the 5G ecosystem (page 5), etc.

PSM COLLABORATION

The crisis has accelerated innovation projects right across the PSM community. It is helping us to bypass natural resistance to change, overcoming the protection of the comfort zone. One example from the membership is the cloud-based production solution, co-developed by VRT and RTBF in Belgium, that quickly went from experimental idea to deployed product (page 7).

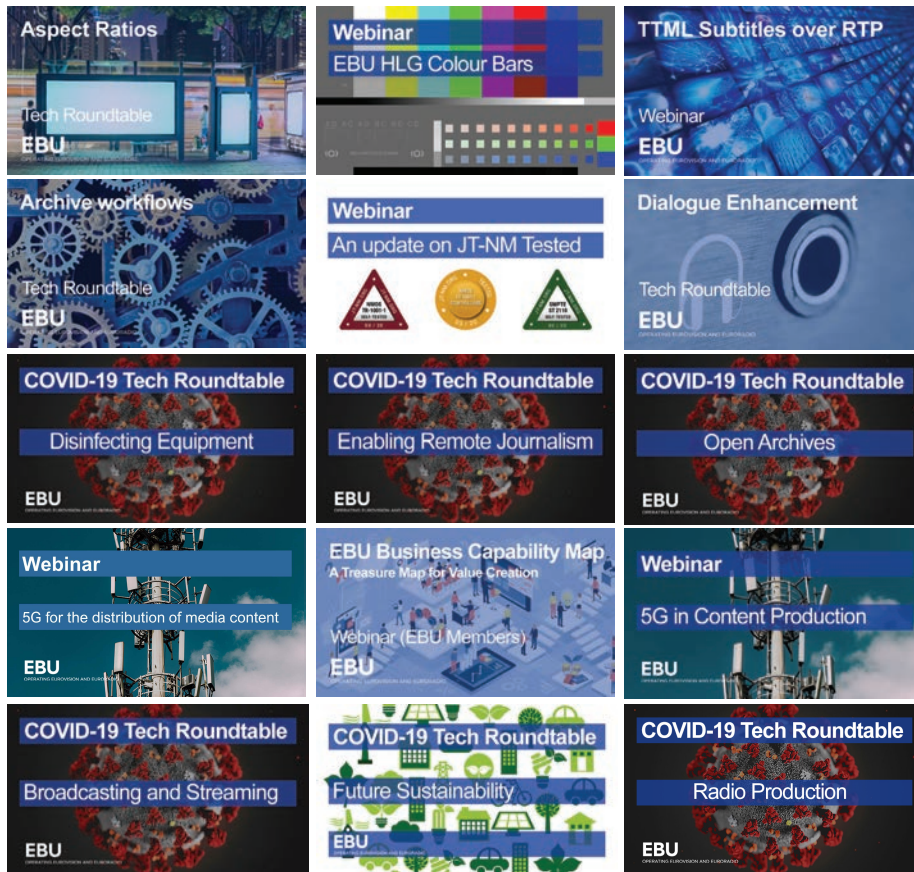
We have seen this same impetus to join forces in a common direction in the active willingness from virtually every EBU Member to participate in our weekly roundtables where solutions and new ideas were proposed to create new and more effective offers for an audience looking again and with more 'attention', towards PSM. New initiatives, that will become public in the coming months, have finally got that convergent quantum of energy that has allowed us to jump across to the energy band where electrons flow without 'traditional' resistance. New projects are now actively supported by a large number of EBU Members and often in collaboration with the whole media industry.

The combination of EBU Members' content and expertise is now permitting the creation of new product initiatives to better inform, educate and entertain European citizens. European institutions are the additional accelerator that could help those initiatives to materialize and continue to resonate well beyond the critical period we are currently living through.

A wealth of knowledge

The COVID-19 pandemic has seen a huge increase in the popularity of webinars and the EBU is no exception. Over the past few months, the Technology & Innovation team, in collaboration with contributors from right across the EBU membership, has offered webinars and roundtables on a multitude of topics.

All of the events below are available to view on demand – simply visit tech.ebu.ch/publications and search for the relevant keywords.



Taking advantage of automation

There are many good reasons why EBU Members should be looking to automation. If otherwise tedious and potentially error-prone tasks are automated, programme-makers are free to concentrate on more important work; and machine learning can create more data about content, which increases the value of that content. Automation also facilitates more flexibility regarding where operations can happen, and where they are resourced, including on location, at broadcaster facilities, or in the cloud.

For many broadcasters, automation will be an unfamiliar area, involving new techniques and technologies, not to mention new terminology. EBU Technical Report 055, published in June 2020, aims to demystify the topic. It describes several automation scenarios for media organizations and explains the key concepts. The report also includes examples of how automation is being used by EBU members for development, deployment and configuration activities.

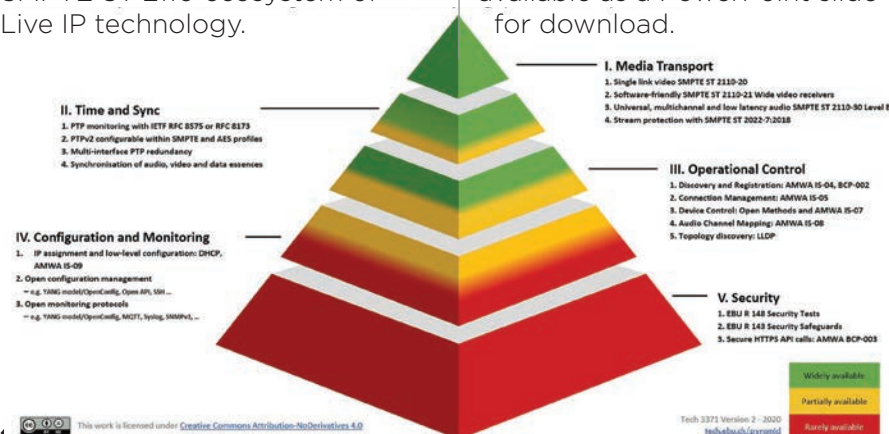
The report was authored by the Automation and Provisioning subgroup within the EBU strategic programme on infrastructure & security. The subgroup was chaired by Peter Brightwell (BBC).

You can download EBU TR 055 from tech.ebu.ch/publications, where you'll also find a webinar about the topic and the report.

An update for the pyramid

The EBU has published an updated version of Tech 3371 and its 'Technology Pyramid for Media Nodes' graphic. The Pyramid is a visual representation of user requirements, priorities and the market's progress in creating and implementing standards and protocols in the SMPTE ST 2110 ecosystem of Live IP technology.

One of the most striking changes is that there is more green in the Pyramid, reflecting a greater maturity of product implementations overall, relative to what the earlier version showed. Some layers of the pyramid were also renamed. The updated Pyramid graphic is also available as a PowerPoint slide for download.



5G: first deployments and first impressions

The EBU's **Darko Ratkaj** examines whether 5G has been living up to expectations when it comes to the promised applications for the media sector.

An article titled '*5G: what it is and what it might become*', published in the March 2019 issue of *tech-i* magazine, looked at how this new technology could make EBU Members' lives easier. We sought to separate facts from the hype, to be critical but open-minded. The first stage of 5G standardization had just been completed, the arrival of the first user equipment was expected, and the network roll-out was about to commence. The focus was still on getting the technology right.

We suggested then that 5G could be useful to EBU Members, provided the suitable commercial and regulatory conditions were put in place.

FIRST NETWORKS

Although the world has changed greatly in the past 18 months, 5G developments have not brought many surprises. 5G-enabled smartphones are in the shops and you can try them. That is, if you happen to be within the coverage of a 5G network, which are currently limited to some large cities. Perhaps this is understandable, as 5G is mainly used to provide consumer broadband – the same service that is available on 4G/LTE networks, which already have widespread network coverage, and on fixed networks. Hence, the network operators are investing in 5G where it makes commercial sense for them.

However, best-effort broadband access will not excite many professional users. For them 5G is attractive because it is designed for very high throughput, low-latency, high reliability, guaranteed QoS, and flexible deployments, including in private networks. Many of these features are beyond the capabilities of the early 5G



How has the 5G for media story evolved since March 2019?

networks and devices. They might arrive later if the market demand materializes and viable business arrangements are found. In that respect 5G is no different to other new technologies.

Meanwhile, the 5G standardization continues at a somewhat slower pace as physical meetings are currently not possible. 3GPP has just finalized Release 16, with many new features and the work on Release 17 is well under way.

In ETSI, different bits of 3GPP specifications that, taken together, define 5G Broadcast have been collected in TS 103 720, due to be approved

GET INVOLVED!

We organize industry-wide collaboration to ensure 5G is fit for media. Individuals can join two working groups: 5G in Content Production and 5G Deployments. Companies can join 5G-MAG.

See tech.ebu.ch/ourwork and 5g-mag.com.

in Q3/2020.

The DVB Project continues developing its flagship DVB-I technologies aiming to provide a unified service layer for DVB services that can run on any infrastructure, whether broadcast, broadband or hybrid. And that includes 5G.

EBU REPORT

The EBU is not idle either. We continue our efforts on building competence within the EBU community, especially through our project groups, publications and events, and our involvement in 5G developments.

The EBU's main objective is to make 5G 'friendly' to EBU Members, both technically and commercially. We know that this requires close collaboration with the industry partners and engagement with the regulators and policymakers. Therefore, we have opened some of our technical working groups to external participants. The results are encouraging; a prime example is the recently published Tech Report 054: '*5G for the Distribution of Audiovisual Media Content and Services*'.

A step up in this respect was the creation of the 5G Media Action Group (5G-MAG), a cross-industry association with a mission to facilitate the adoption of 5G technology in the global media sector. These are still early days, but 5G-MAG is up and running and its work is gathering pace.

In a broader 5G context the focus is widening to include commercial, regulatory and policy aspects where new questions arise around equipment availability, network security, resilience and coverage, safety, and health impact.

We will keep you posted. Stay tuned and stay well.

Pivoting to the cloud for production

The quest to build and integrate cloud-based workflows for real-time live production has begun, write **Hans Hoffmann** and **Ievgen Kostiukevych**. The EBU will ensure broadcasters get an edge as the ecosystems evolve.

COVID-19 caught the world off-guard. All industries urgently needed to come up with solutions for business continuity. For broadcasters, this meant finding remote and distributed production solutions. And for most of them, the cloud, in one form or another, was the answer.

The real-life proofs-of-concept that resulted have demonstrated clearly that using the 'public cloud' for remote and distributed media production, and even live, is a genuine value proposition for the future. And while some broadcasters have opted for 'cloudifying' their existing workflows, others have successfully started using the growing portfolio of native media-tailored services from cloud providers. These first solutions have not been perfect – far from it – but they have provided quick and effective solutions under highly unusual and difficult circumstances.

STUMBLING BLOCKS

It quickly became apparent that most of the in-studio standards and protocols currently used are not designed for cloud-based systems. The architects had to evaluate the connectivity type (public internet, direct, or WAN connection) and, depending on the options, consider link properties like latency, reliability, security, and bandwidth requirements.

Another stumbling block was that the public cloud is asynchronous, both historically and by nature. Imaginative hacks were required to enable synchronous and time-sensitive workflows. Public cloud providers are only now starting to investigate offering multicast and PTP for their customers. While the offer of native media services is continuously expanding, and synchronous

“The change that is now under way will be even more dramatic than the transition to IP initially seemed five years ago. New paradigms need to be adapted – and very quickly!”

workflows may be enabled in the future, we must nevertheless ask *what portion of our production remains truly time-sensitive?* Where can compromises be made in favour of greater flexibility?

Up to now, broadcaster adoption of IP-based technology for live production has focused on the 'ST 2110 plus NMOS' ecosystem. Though the complete protocol stack isn't *quite* there yet, early implementations have provided confidence that it *will* be the go-to solution to offer reliability and flexibility for open high-performance uncompressed infrastructures. ST 2110 plus NMOS provides a solid basis for on-site time-sensitive infrastructures, like local MCRs and local IBCs. However, for high-quality live production, uncompressed UHD/HD bit rates can quickly make the use of cloud-based systems impossible. There is a clear need for new mezzanine bit-rate compression solutions that will ensure manageable bandwidth and costs, even for high-value high-quality cloud-based or hybrid productions.

NEW STANDARDS?

There is a lot going on. Some of the big industry players are investigating ways of retrofitting existing solutions into a 'cloudy' future. In parallel, SDOs have launched initiatives to enable time-sensitive cloud applications in a relatively seamless way. Examples include AES67-over-WAN from the

Audio Engineering Society or the ST2110-WAN and GCCG (ground-cloud-cloud-ground) projects from the Video Services Forum.

SRT (open source) and RIST (standardized by VSF) both solve at least one of the essential puzzle pieces in contribution applications, targeting video transport at low latency over unmanaged networks. Although both are asynchronous, they are supported by major cloud providers either as a native offering or with minimal integration required.

The change that is now under way will be even more dramatic than the transition to IP initially seemed five years ago. New paradigms need to be adopted – and very quickly! The cloud giants are investing much more into R&D than a union of broadcasters can afford. They will soon take the media industry by storm with new offerings that are not built on a legacy broadcasting mindset. We will have to live with that, adopt them, and use them to our benefit or, in the longer term, be bold with a European counterpart cloud like GAIA-X.

In any case, we need to establish constructive dialogue as a collective with cloud providers. By giving them early insights on what kind of solutions work and which requirements are still to be addressed, there is an opportunity to shape these upcoming offerings.

How COVID-19 accelerated cloud-based production in Belgium

In the rush to quickly address the challenge of producing television during a lockdown, ongoing research at the Video SnackBar Hub provided the right solution at the right time. **Karel De Bondt** (VRT) and **Hugo Ortiz** (RTBF) tell the story.

In actively seeking to understand the future of broadcasting, we had been eager to explore how software solutions derived from the live streaming and gaming world could improve the workflows of live multi-camera video production. Through a collaboration with the Video SnackBar Hub (see boxed text), we were studying the readiness of cloud infrastructure for live multicam production. We found that the combination of cloud-based virtual machines – each with a dedicated GPU (graphics processing unit) – and the well-known live production software vMix enabled us to produce live shows of moderate complexity. And with the arrival of the COVID-19 pandemic, what initially served as a research study quickly became reality.

LOCKDOWN!

As of mid-March this year, Belgium went into lockdown. This served to accelerate our work and brought it into the spotlight. By the end of the second lockdown week we had produced live on-air content from the cloud with this setup.

It turned out that the hardest part was not the

The **Video SnackBar Hub** is a community of like-minded media players from both public and commercial media organizations. It's designed to support and connect content creators internationally while helping them explore new technologies, ideas and workflows. Besides collaborating on web video, podcasting, live streaming and future broadcast technology, the hub also facilitates the exchange of knowledge with other innovative media companies. Launched as a VRT initiative, in close collaboration with RTBF, the Video SnackBar Hub now has 13 members, including Red Bull Media House, TV2 Norway, SBS, Radio France, Yle and others. Visit: videosnackbarhub.com



One of the first recordings of VRT's Ketnet that used the cloud-based set-up, on 26 March 2020.

technology itself; rather, it was to train and engage everyone involved in the production. The necessary buttons had to be pressed and everyone had to communicate in a clear and timely manner. Even once the lockdown had finished and people in Belgium could get back to work, content producers at VRT and RTBF continued to use this co-built infrastructure. On top of that, we have continued to improve



Trial setup, with a special guest!

its operation in preparation for a possible second COVID-19 wave.

TUTORIAL AVAILABLE

The lessons we learned have been gathered in a tutorial paper called *How to set up a cloud-based high-end live remote multicam production* (see tinyurl.com/vsh-tutorial). It explains how to set up a virtual machine (with dedicated GPU) in the cloud, suitable for live multi-camera production. The paper also shows how to set up and run a vMix production on this machine. We provided an overview at the EBU's online Network Technology Seminar 2020. (EBU Members can access the video at tech.ebu.ch/nts2020.)

Another Video SnackBar Hub project that generated a lot of interest during the lockdown, was the organization of two webinars on how to continue media production during the pandemic. In these interactive seminars, content creators and technologists from media companies all over Europe and the US shared tips and tricks on how to adapt normal daily work practices to the quarantine circumstances. People from all over the world joined the webinar, sharing thoughts and questions in the chatroom. Both webinars are available to view on the Video SnackBar Hub website.

Partnership is central to radio's in-car future

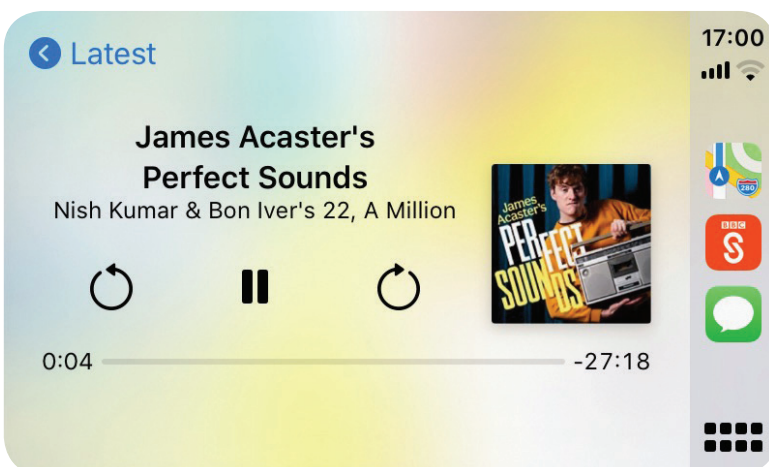
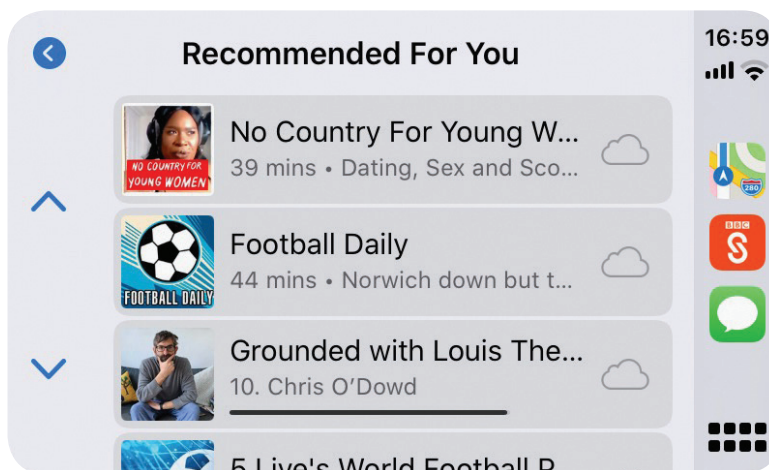
Asha Knight, Distribution Manager for BBC Digital Partnerships, outlines the organization's plan to maintain prominence for BBC's audio services in connected cars.

My role within the BBC Digital Partners Team predominantly looks at radio and music. Some of the questions I seek to answer are whether there is new technology out there that will help BBC reach new audiences through its radio and music output; or how we can work with existing partners to improve, build upon or extend our radio and music output in a way that's compatible with BBC's distribution policy. I also investigate which external influences will shape how people consume radio and music moving forward and how we can collaborate in this.

It is then, perhaps, unsurprising that a lot of my energy recently has been focused on connectivity in cars. This is particularly important to us at the BBC because roughly a third of all radio listening takes place in the car, representing around 13% of all time spent with the BBC by our UK audiences. (To put that into perspective, that's only a little under half the time spent with our flagship television channel BBC One - so it's clear that a significant proportion of the value the BBC offers to its audiences is in the car.)

FROM AUX TO DASHBOARD

Both the auto industry and the



BBC Sounds on Apple CarPlay

audio industry have changed exponentially in the last decade and will continue to do so. Ten years ago, I would endlessly

listen to BBC Radio 1 in the car but on those rare occasions where there was nothing decent (e.g. weekend evenings, which even now are exclusively reserved for the kind of dance music I loathe), I'd experiment with plugging an AUX cable into an iPod of predownloaded music.

Fast forward to last summer when I hired a car with Apple CarPlay, enabling me to stream whatever I wanted, wherever I wanted, from my phone. These phone-tethered solutions, though, are the tip of the iceberg: car manufacturers are now predominantly focused on creating embedded connected solutions within the car dashboard, with no onus on the driver to use their mobile phone at all. For public service media (PSM) organizations like the BBC, this leaves us wondering, *within connected vehicles that offer a diverse range of on-demand listening options, how can we help preserve and evolve the unique experience that radio gives drivers?*

One response to this, was the creation of BBC Sounds, which is presented to users as "your favourite programmes, podcasts, radio stations and music all in one place".

Since BBC radio began in 1922, we've put audiences at the heart of our content and distribution. The BBC's mission is to "serve all audiences through the provision of impartial, high-quality and distinctive output and services which inform, educate and entertain". It is this need to provide a broad range of content – consistently high in quality but diverse in nature, providing something for everyone – that drove us to design BBC Sounds. When it became clear that online listening was increasing and that new technologies and innovative commercial products were shaping audience expectations, it was essential for the BBC to develop a service that could keep pace.

BBC SOUNDS IN THE CAR

Now we have that service, alongside traditional linear broadcast radio, we need to ensure that it is working in every environment in which it is used, including the connected car. While creating a brilliant PSM audio product is part of the picture, ensuring that these services – and traditional radio – have due prominence and are accessed easily by drivers is another crucial part.

We recognize, however, that we are not alone in this. All broadcasters – both PSM and commercial – have a vested interest in adapting and securing radio's central position within cars, which is the primary reason the EBU Connected Car Group was formed (see separate article).

Without some protection, whether delivered by regulation or commercial negotiation, broadcasters will lose the essential benefits that provided the foundation for the pre-digital market: prominence for radio in the infotainment space; editorial control over what content is delivered and how; direct attribution back to the content-maker's brand and – for commercial broadcasters – the ability to receive revenue

directly from advertising.

In addition, in the emerging, fractured market broadcasters are at risk of losing probably the most important key to success in the digital world: the ability to receive, own and use audience data.

RADIOPLAYER'S ROLE

The best way to counter these risks is to work together as an industry to support car companies in delivering high quality hybrid radio experiences into cars, direct to a fully connected dashboard. The BBC is a shareholder in a joint venture, Radioplayer UK, that aims to do just that. The initiative offers a simple exchange. On one side, Radioplayer will develop technology and support open standards for hybrid radio, which all broadcast partners can work with. It will guarantee carriage for all partners' services (radio stations and apps), across Europe.

On the other side, it will offer car manufacturers a simple solution: access to its basic aggregated metadata delivery system along with a set of designs, sample code, technical support, and radio-product design principles. And all this at no cost, providing the car manufacturers support its standards and include all stations and services.

I wrote above about how I accessed audio in cars ten years ago versus today. I believe that in another ten years' time, when I switch my car on, BBC Radio 1 will be as easy to find as it is now. Additionally, the service will be flawless, the metadata will be richer, and when the dance music kicks in, a BBC Sounds podcast will be recommended to me and will be as easy to access as the radio is.

One thing is for certain, we – the radio industry – won't be able to achieve this unless we work together.

Join the connected cars discussion

Ben Poor, EBU

Connected devices, especially for in-vehicle entertainment, are key platforms for EBU Members. This is an area that brings both challenges and opportunities for public service media (PSM). It is about making use of broadcast, for ensuring the reach of content, alongside the internet for personalization and attribution.

The EBU Connected Cars and Devices group provides a forum for Members to discuss their projects and strategies, as well as discovering what might lie in the future. Engaging with both the auto industry and the Big Tech companies is another key strand. Discussions like these catalyse collaboration and the development of an aligned vision in a way that is good for PSM and thus good for audiences.

Ensuring free and fair access to in-car platforms for PSM is essential, now and in the future. Important aspects include prominence and discoverability, as well as finding agreement on the need to maintain the direct link between PSM organizations and their audiences. The Connected Cars and Devices group is an ideal place to define and work towards these goals.

For more information contact Ben Poor (poor@ebu.ch) or visit: tech.ebu.ch/connected-cars

At the cutting edge of metadata for media

The annual MDN Workshop is a veritable treasure trove of resources and inspiration for getting more out of metadata. Here we present just a small selection of the models and use cases that were presented at last June's event.

Unlike most other EBU T&I events, the presentations from the MDN Workshop are not behind a login – we want to spread the metadata gospel far and wide!

Find these and many more contributions from the Metadata Developer Network at: tech.ebu.ch/mdn2020

PITFALLS OF OFF-THE-SHELF AI

Hanna Lukashevich, Fraunhofer IDMT

Applying off-the-shelf AI-based solutions for automatic metadata extraction often delivers unexpected or undesired behaviour and unsatisfactory results. This mismatch between the expectations and results is rooted in various types of bias that are introduced along the AI pipeline. The developer of the AI solution makes multiple non-technical decisions on the choice of metadata categories and classes, and selects representative training and test data along with evaluation measures for quality control. Often these decisions are strongly influenced by the most easily available high-quality datasets and are not necessarily consistent with later use cases.

AI is not magic. The mathematical concepts within AI require consistency of assumptions on data across training and at deployment. As every business is unique, AI components must be adapted, but it is usually worth the effort to achieve a solution that really fits the business.

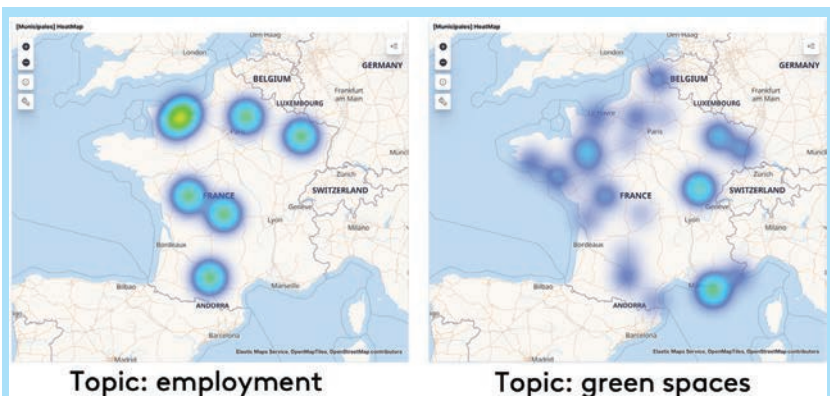


Figure 1: AI-based tools allowed France Télévisions journalists to tell new stories during the local election campaign in spring 2020.

POLITICAL STORYTELLING IN FRANCE

Matthieu Parmentier, France Télévisions

In February 2020, campaigning began for local elections across 36,000 French cities. A few weeks before, France Télévisions had launched a new department dedicated to data and AI, and this period of political campaigning offered an ideal opportunity to conduct some first experiments.

When it comes to political debates, commentators and data journalists can benefit greatly from tools that take advantage of speech-to-text, facial recognition, OCR (optical character recognition) and natural language processing technologies. By recognizing and classifying topics associated with their respective speakers, these

tools allow the production of meaningful statistics for each debate. Combining data from several debates enabled new stories to be told, making use of charts, timelines or maps (Figure 1). Beyond political debates, the same tools help with describing content and extracting insights to enrich metadata and serve concrete use cases such as indexation, recommendation or marketing. These analysis tools are now in production, available for other applications. They were used, for example, to analyse the 16,000 sentences written by France Télévisions' employees asked to describe their work experience during the COVID-19 lockdown.

PERSONALIZING NEWSLETTERS IN BELGIUM

Emilie Nenquin, VRT

Big Data, User Data, Metadata, ... There are many buzz words, but what can we do with all this data? At VRT we want our data projects to generate immediate added value for the end user. Data sources are ingested into our data lake if they are needed for a use case and only if that use case generates direct value to the end user.

This principle was applied to optimizing our digital communication based on user data and metadata. We performed different tests with impressive results. Personalized newsletters for our on-demand platform, based on location or topic, resulted in increased open and click-through rates of respectively 30% and 55%. This personalization reduced the churn rate (unsubscribes). And alerting users to the fact that content on our video platform would disappear within six days drove an average of 3-7% of recipients to watch that content in the days after receiving the message.

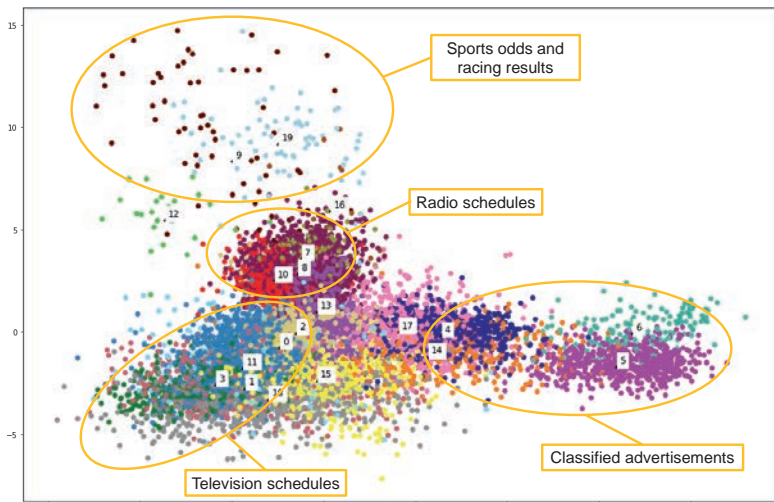


Figure 2: At ABC, the Doc2Vec technique is used to distinguish radio and television guides from similar content

ANALYSING SCHEDULES IN AUSTRALIA

Lizbeth Moore, Trish Hoyne and Michael Easthope, ABC

Last year, the information governance team of Australian broadcaster ABC set out to see if it could produce a single set of data that would consistently identify and describe every programme broadcast or published on ABC – television, radio or online – since 1932. Using EBUCore, EBU CCDM and the EBU media value chain, along with the EIDR (Entertainment Identifier Registry) content and video services data models, the team developed a semantic data prototype, **abcCodex**.

The prototype uses these data models, pattern recognition and natural language processing to transform digitized radio and television guides in newspapers and magazines held by the National Library of Australia into a set of semantic data that describes the ABC's scheduled broadcast events and programme information. The prototype will make this information available to internal users at ABC, audiences and stakeholders to browse, search, query and integrate using ABC's in-house semantic service platform.

LINKING METADATA FROM END TO END

Mark Gülbahar, IRT

The **dwerft** project aims to maintain *all* metadata created throughout processes along the *entire media value chain*. Why? Because metadata is *key* when we talk about searching and finding audiovisual content. And key to being found as a content provider across all distribution platforms.

Although precise metadata does exist, it gets lost within the various processes. Creating metadata *manually*, as it is – still – done nowadays, is highly expensive, and the same goes for AI.

We're following a completely different approach that we believe could revolutionise the future of media production, by gathering, structuring, and reusing all metadata created throughout the entire production process on a semantic, meaningful level.

With **dwerft**, all data for a production can be queried or edited at *any* point in time, and the manual takeover of data becomes obsolete. Linking to external ontologies and knowledge bases (such as DBPedia, IMDB, etc.), as well as other features, complete the solution.

More details on the architecture, as well as some of the novel, ground-breaking scenarios in development, are available here: dwerft.de/en/scenarios/

GETTING SMART ABOUT DATA PLATFORMS

Jürgen Grupp, SWR; Fabius Klemm, SRG SSR

"Poor data quality is the unintended consequence of data silos and poor data & analytics governance." This statement, from a 2019 Gartner report on data management, sounds so true if you have ever encountered the atonal triad of application integration: siloed applications, limited APIs, and vendor-specific data models. Aargh!

What can we do? We need to break up the silos. We need to link our data and create value from them. And we need to speed up integration. But how? Our current integration patterns – "point-to-point" and "bus" – won't suffice. We must add a new one: smart data platforms (Figure 3).

Smart data platforms reduce vendor lock-in and increase data ownership. They reduce time-to-market and increase opportunities to exploit potential. They are cloud-ready and an ideal source (and target!) for AI applications. If this all sounds appealing, you can learn more by watching our presentations from the 2019 and 2020 MDN workshops.

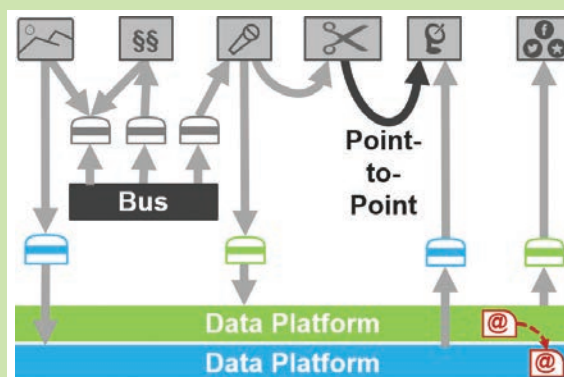


Figure 3: Adding a new integration pattern for data

How does digital transformation happen in the real world?

April 2020 saw the publication of the Digital Transformation Initiative Casebook, a report showcasing inspiring projects from across the EBU membership. **Sasha Scott**, who led the report's creation, explains how the Casebook, and a forthcoming Playbook, can help Members.

Digital transformation means different things to different people, with many associating it primarily with technology and tools. Even if the media industry has developed a broader and deeper understanding of the term in recent years, it is still a valid question to wonder how *operating remits* or *workforce agreements* fit into the digital transformation picture. However, when you start to unpack these issues and see what they look like for Members, the links and the complexities become clear.

UNBLOCKING TRANSFORMATION

At Rai, long and highly politicized negotiations over a new public mandate resulted in the legal obligation to become a digital and multimedia organization, to drive innovation, and even to raise digital literacy levels in Italy. Similarly, France Télévisions negotiated a landmark legal agreement that enables the company to recruit new staff with the digital skills needed for their transformation and develop a training programme to upskill current staff. These were major blocking points before.

Both these examples show that despite being far from 'digital' issues themselves, they were highly strategic activities that have proved critical in enabling the transformation of these companies. This is why we always emphasise that digital transformation can never be reduced to technology alone.

At the EBU Digital Transformation Initiative (DTI), our focus is organizational change – speeding up the way things work, flattening hierarchies, being data-driven, developing future skills, and leveraging the processes and



practices of technology – to build PSM that are more agile, experimental and adaptable to change. Approached like this, 'digital' is the context; it's the world we live in.

It's not always an easy message to get across. Our first step was to develop a framework that brought all these enablers for transformation together, but it remained a bit in the abstract. So, we wanted to make it real through the work of Members. This is why we have written the DTI Casebook. It contains 18 examples that cover the broad spectrum of transformation, from leadership to data, and from partnerships to innovation. The point is that successful transformation needs a holistic approach across all the dynamics and domains of a PSM company. Without the big picture, efforts will only ever be partial, and impact therefore limited.

CASEBOOK & PLAYBOOK

It was really important to us that the stories were told through the voices of the people responsible, so the reader really gets the feel for what transformation looks and feels like on the day-to-day, operational level. The Casebook is not a 'how-to' manual, but it

provides a lens for looking at your own company and asking "does this, or something like this, exist in my company? Could it, and if not, why not?" And understanding the "why not" is crucial.

The Casebook is the first of a pair of complementary reports. The second – the DTI Playbook, available later this year – focuses on the design and execution of company-wide transformation initiatives. The two reports will combine as a tool to help Members refine their own approach to transformation.

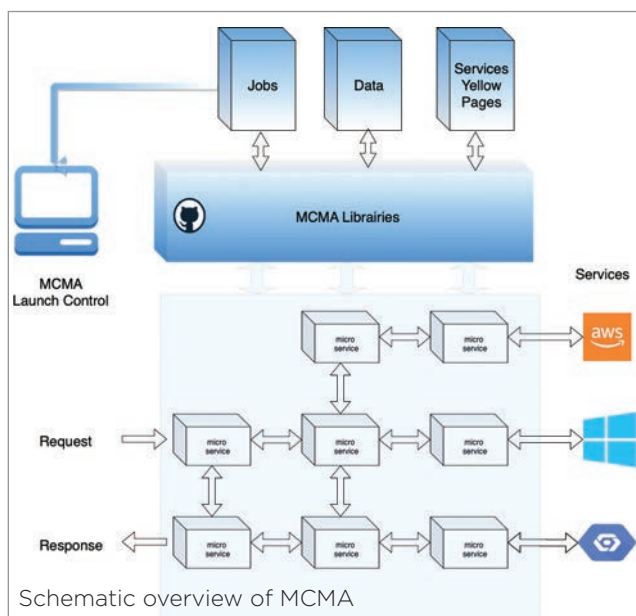
Just as we were finalizing the Casebook, COVID-19 spread throughout Europe. Now, nearly five months on, we can clearly see both the huge disruption and acceleration caused by the crisis. The principles in the framework and the examples in the Casebook still hold true. I would argue, however, that the crisis has moved the imperative for transformation from important to critical, and the cost of failure has risen exponentially. At the same time, seeing how Members have responded is both encouraging and inspiring.

EBU Members can download the DTI Casebook here: ebu.ch/digital-transformation

Shifting to OPEX through serverless and microservices

Alexandre Rouxel describes how an EBU-led open source project enables media companies to shift from CAPEX to OPEX for a range of functions by embracing serverless architecture and microservices.

Most broadcasters today are using cloud services in some ways, but the cloud continues to change fast, and attractive new possibilities have opened. The latest trend is towards 'serverless' architecture and what is known as FaaS – function as a service – opening the door to an entirely new way of running media services. Importantly, by adopting FaaS, media companies can shift their costs from CAPEX to OPEX, a key benefit of moving to a cloud-first strategy.



a service – so the scaling of the underlying containers to absorb the workload is managed by the cloud providers. With the functions directly exposed to the users, the development of the related applications or services is simplified and the time to market is reduced. The MCMA group has worked closely with the cloud providers to optimize the use of native cloud services and still provide interoperability across providers. CI/CD (continuous integration and continuous delivery) pipelines are an essential part of MCMA.

FREE & OPEN SOURCE

An EBU project called MCMA, standing for Media Cloud Microservice Architecture, provides a painless way of adopting serverless architecture and implementing media workflows in the cloud. Created as an open source project, free to use and available on GitHub, it offers reusable services that can apply to all applications and infrastructures across multiple cloud providers.

As proof that it is production-ready, MCMA has been used at Bloomberg for almost two years now, across a variety of media workflows from production to distribution. A primary contributor to MCMA, Bloomberg reports that the implementation of MCMA-based workflows has improved leveraging of cloud-based resources and alignment with both technology and business goals.

To benefit from serverless and FaaS, it is necessary to have a strategy for the architecture, configuration and deployment of your code. This is precisely what MCMA offers. The use of

'microservices' involves breaking the media services – which could be used for anything from speech-to-text to publishing content to social media platforms – into small functions that can be spun up and run directly in a 'container' on the cloud.

Because cloud providers use a pay-as-you-go principle and linear charges, also imposing a maximum running time of 15 minutes for any single function, the costs are entirely predictable. There is an incentive to define the microservices so that they won't hit the time constraint barrier – more is better! Keep in mind, however, that there will be a 'cold start' effect: if a resource needed for a function is not requested, the container is stopped, and it takes some time to spin it up.

SIMPLIFIED DEVELOPMENT

Another benefit of FaaS and MCMA is that developers can remain focused on the development of the functions defining the application. The work happens one level of abstraction up from the previous approach known as IaaS – infrastructure as

Enhancements have been made over time to streamline accessibility and simplify the learning curve for deploying and managing cloud infrastructure. MCMA comes as a set of libraries – developed on different cloud platforms, AWS, Azure and GCP – that allow you to sequence services and to track and manage jobs. The libraries and foundational services take into consideration security and management best practices for cloud infrastructure. MCMA provides three main types of services related to:

- Data storage and operations;
- Job execution and management; and
- Service definition and abstraction.

The MCMA group, chaired by Bloomberg's Chief Architect Loïc Barbou, has begun a standardization process at SMPTE and the Open Services Alliance for Media. The core of the standard proposal is about job management, message formatting and activity tracking. *Learn more about MCMA:* tech.ebu.ch/groups/mcma

Many languages, one interface

EuroVOX is the result of an EBU collaborative development that is helping Members to reduce cost and complexity when it comes to transcription and translation. **Ben Poor** explains how it works.

Translation and transcription tools have become commonplace at broadcaster facilities, as journalists and programme-makers use of and produce content in multiple languages and for multiple purposes. In a globalized world, the ability to shift seamlessly from one language to another helps to ensure the flow of news, culture and entertainment.

Typically, EBU Members make use of language tools from different vendors to fulfil different use cases. Some tools might be stronger in a given language, or others for a particular type of content. And the quality and performance of these machine-learning-based tools will vary over time as models are updated and refined.

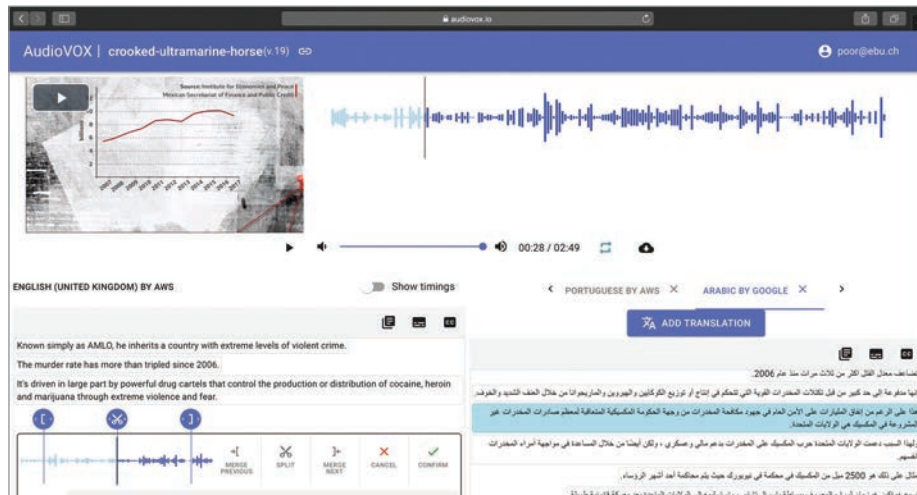
INTEGRATION COSTS & LOCK-IN

One of the challenges of using multiple tools from multiple vendors is that each one involves integration into your existing production workflows. This leads to added costs over and above the usage fees for the tool itself, and a tendency towards vendor lock-in.

Fortunately, the EBU has developed a solution for this problem.

EuroVOX is an open toolkit that allows single integration to multiple language tool vendors. It consists of a core layer that serves as a single open API for machine-learning-based language tools, along with additional tools that provide a tailored interface for specific production tasks.

For EBU Members, the EuroVOX core layer is already freely available for deployment. It is currently being deployed by IRT and the Eurovision News Exchange on a trial basis, with more members interested in either using an EBU-hosted service or running it on their own



infrastructure.

To deploy the EuroVOX core layer, both code and Docker images are available to deploy in the cloud or entirely on-premise. Adapters for several different vendors are already available, meaning you need only to add your credentials to start using them. Alternatively, writing adapters for additional vendors or your own technology is straightforward.

The advantage of implementing EuroVOX on your own infrastructure, even if you use a limited set of vendors, is that it allows the freedom to easily change vendors at a later stage. For example, if your organization decides to start producing content in a new language that requires a new vendor, you can change or add providers at the push of a button. A one-time integration of EuroVOX avoids the need for additional integrations of other tools later on.

EuroVOX TO AudioVOX

Other tools available in the project include AudioVOX (see screenshot), which uses the core layer to provide a web-based tool for easily transcribing and translating audio and video content. This makes it possible to ingest video content, transcribe it using a choice of vendors, add

multiple transcriptions using different vendors and re-render the video in a choice of outputs. These include a re-spoken audio track, burned-in subtitles in the original language, or embedded subtitles in multiple translated languages – a versatile tool for making content truly multi-lingual. AudioVOX also allows an editor to rapidly make corrections to the transcription, translations, or even the timing of sentences. This ease-of-use increases the amount of content that can be transcribed and translated. Additionally, the tool is designed to be integrated into existing production workflows.

EuroVOX users can also access regularly scheduled benchmarking to compare the performance of different vendors and automatically propose the right vendor for the right task.

The roadmap for the project includes adding real-time transcription and speaker diarization, as well as methods to enhance tools like AudioVOX with collaborative editing – allowing teams of producers to work on the best transcription and translation for content.

To learn more about EuroVOX, to try it out for yourself, or to join the collaboration visit: tech.ebu.ch/eurovox.

All together now – 100 sustainable productions in Germany

The German film and television industry has come together to collaborate on reducing the environmental impact of their productions. **Philip Gassmann**, a Munich-based expert in sustainable production, describes some of the steps being taken.

Creating a nationwide system for green film and television productions in Germany. This was the main idea behind a project that has been over three years in the making within the “Green Shooting” group, initiated by the MFG (Film Fund Baden-Württemberg) and joined by the Film Fund Hamburg. The group meets several times each year and attracts more members every time.

The project has now evolved into an unprecedented initiative involving almost every major German television channel (both public and private), along with several production companies, film funds and associations. Together they have committed to “100 Green Productions” during 2020 and 2021.

GREEN GUIDELINES

I was asked to write the rules and guidelines for this effort. I wanted them to be as simple and – most importantly – as effective as possible in terms of environmental impact and success. We ended up with a set of 17 guidelines that cover the most important aspects of this issue subdivided into three categories:

1. Reduction of CO2 emissions, the main driver of climate change;
2. Using fewer natural resources;
3. Protection of the environment against harmful substances.

Our main focus is on the use of energy and fuels, as this is where we have the potential to achieve the highest savings in terms of CO2 emissions. Switching to renewable electricity in general means 80–90% less CO2 in Germany. And there are many other important steps we can take.

When it comes to car fleets, allowing only hybrid, natural gas or electric cars results in a 50–90% reduction in CO2 *and* other harmful substances. Also related to transport, flights are only allowed if the equivalent train ride lasts longer than five hours. This again has a major impact on our carbon footprint.

When the crew reaches the destination, hotels are often another big CO2 factor. We encourage productions to switch to sustainable hotels with renewable electricity or to use apartments and houses, which have a much lower impact in general.

Turning to the production site, diesel generators must be avoided or replaced by hybrid systems, which usually also means at least 50% less CO2. Big LED units and innovative lighting systems can replace many conventional light sources and help reduce both consumption and the size of the generators required. Constructing sets with sustainable materials and especially reusing them has proved to be another huge positive factor.

PROOF OF CONCEPT

I am very confident that we can lower the emissions of our industry dramatically by following these rules. And that is what we’re testing right now. As a proof of concept, the “100 Green Productions” are combined with a scientific evaluation of the project, and the efficacy of the measures and the system itself.

Another key finding: a sustainable film or television production is on the winning side financially-speaking as well, since our aim is to save energy, fuels and materials. And even on the creative side, many green technologies offer new creative tools and possibilities.

So, watch this space... to be continued!

The EBU has established a sustainability working group. For more details please visit tech.ebu.ch/green or contact Hemini Mehta (mehta@ebu.ch).



Stepping up media quality – the challenge of the transition

David Wood suggests that having to replace user's equipment can present a decisive barrier to the evolution of media systems



“Making the transition to the next step in the media experience can be a mountain to climb if users will need to change their equipment.”

How difficult is it to introduce a new system, once one is established? In media, one of the barriers making that ‘step up’ ever more difficult once a base service is available, is that you may have to persuade people to change what they are already using and may be happy with.

Look at radio. By the time DAB was developed in 1989 there were already about 400 million analogue radio sets in daily use in Europe. In the beginning, DAB seemed (including to the author) to be the brightest star in the universe: more radio stations and better sound quality. Who could ask for more? Today, thirty years later, DAB (or the more advanced DAB+) is certainly successful in some countries, but it has not swept the world. Recently, the Republic of Ireland even turned off its DAB+ trial services, which were barely listened to. Back in the day, did I and others underestimate the difficulty of persuading people to change what they already have? If I said today: “How about changing to a DAB+2?”, what would you say?

How about the internet? Since the 1970s, the basic Internet Protocol has been IPv4. It has been at least twenty years since an improved version, IPv6, was developed as an intended replacement for IPv4, with a much larger capacity for internet addresses. It then sounded (once again, including to the author) an obvious need and an obvious step up as internet use grew. Yet today, IPv4 still routes most internet traffic. Changing to IPv6 requires people to change equipment – and this, it seems, is asking a lot.

DIGITAL TV: AN EXCEPTION?

Maybe having taken a first step to digital television, it is also going to be a lot harder to take the next step up? The transition to digital television's first step was

successful, and indeed aspects of the second step. But will that be the exception or the rule? The cable television delivery system DVB-C, developed in the 1990s, was certainly a success. A second step, DVB-C2 was developed a decade later and offered higher capacity, more advanced compression, and greater flexibility. A version specified for Japan could carry 8K video – how forward-thinking can you get? The set makers (and me) were enthusiastic. Did DVB-C2 actually get used? You know the answer – it is no...the transition was going to be too difficult.

About eight years ago, new image and sound systems requiring new equipment were developed; UHDTV-1, UHDTV-2, and Next Generation Audio. They can offer better images and sound. Going further, today, new compression technologies have been developed, and should be available in the coming years. They will reduce the bandwidth needed by new systems, and thus make it more feasible to broadcast them, as far as radio spectrum is concerned. But will that be enough for success?

MOST DIFFICULT BARRIER

When it comes to making decisions about introducing new services, maybe the hard decisions will not be about technology alone, but about whether and how the new systems can be introduced, carrying with them the acceptance of all? Will all those in the chain who need to be, be persuaded to change their equipment?

Though far from the only barrier, a lesson of history may be that making the transition to the next step in the media experience can be a mountain to climb if users will need to change their equipment. This may be even the most difficult barrier to the evolution of the media.



Weaving a better web for media

The world has come to rely on the standards created within the W3C, where **François Daoust** is Media & Entertainment Champion. He explains how they are collaborating with partners to build an even better web for media.

The World Wide Web Consortium (W3C) brings together web browser vendors, device manufacturers, media companies, research institutes, etc. to standardize the Open Web Platform. This platform is the most widely deployed and interoperable platform for applications, services and now media, thanks to HTML5, TTML, WebVTT, Media Source Extensions (MSE), and Encrypted Media Extensions (EME). These standards are what brought audio, video, captions, adaptive streaming strategies, and media content to the web in a standardized format.

REINFORCE CORE MEDIA SUPPORT

Work on core media standards resumed in the Media Working Group mid-2019. The group develops the Media Capabilities specification to expose information about the decoding and encoding capabilities for a given format, and

output capabilities to find the best match based on the device's display. The group is also responsible for revising the media extensions, and for additional standards such as the picture-in-picture API.

Meanwhile, the Timed Text Working Group continues its work on captioning standards for the web in collaboration with the EBU Timed Text group and other organizations. The TTML2 and TTML Profiles for Internet Media Subtitles and Captions (IMSC) 1.1 standards were published at the end of 2018. The TTML IMSC 1.2 revision, preliminarily published in June 2020, makes it straightforward to create a document that also conforms to EBU-TT-D. The EBU and W3C also collaborated on BBC's work to define an RTP payload for TTML (RFC8759) at IETF.

Support for web technologies is more fragmented on constrained media devices, such as televisions or games consoles, than on desktops and smartphones. W3C collaborates with the CTA WAVE Project to publish annual snapshots of the Web Media API specification, listing common technologies that compose the web platform. The project's test runner has also been merged back

into Web Platform Tests, which contains existing test suites for web standards.

CREATING THE FUTURE

The richness of the web platform comes from its ability to extend itself and mix technologies. Media technologies are part of a larger ecosystem. The Media and Entertainment Interest Group acts as a steering committee for media standardization in W3C and tracks gaps and solutions under exploration in other groups and organizations. Proposals include the WebCodecs API to expose encoders/decoders to applications; an API to synchronize rendering of overlays with rendering of video frames; work on WebTransport for low-latency media streaming; VR/AR technologies; and a WebGPU API to replace WebGL. Together, these and other technologies will help create rich media experiences that mix media and user interactions in real time, such as customized sports events or live e-commerce experiences.

Web standards development is a multi-stakeholder process. Engagement is key to shape the future of the web. Broadcasters are represented through organizations such as CTA or the EBU but can also take a direct and active role in W3C's activities. For instance, BBC co-chairs the Media & Entertainment Interest Group and the Timed Text Working Group mentioned above, and also leads incubation work on the DataCue API to expose timed data from media resources to web pages.

Learn more and get involved at www.w3.org.



François Daoust,
Media & Entertainment
Champion at W3C.

How did radio fare during the lockdown?

David Fernández Quijada, Manager of the EBU's Media Intelligence Service, reports on how COVID-19 brought some dramatic changes to the way audiences consume radio.

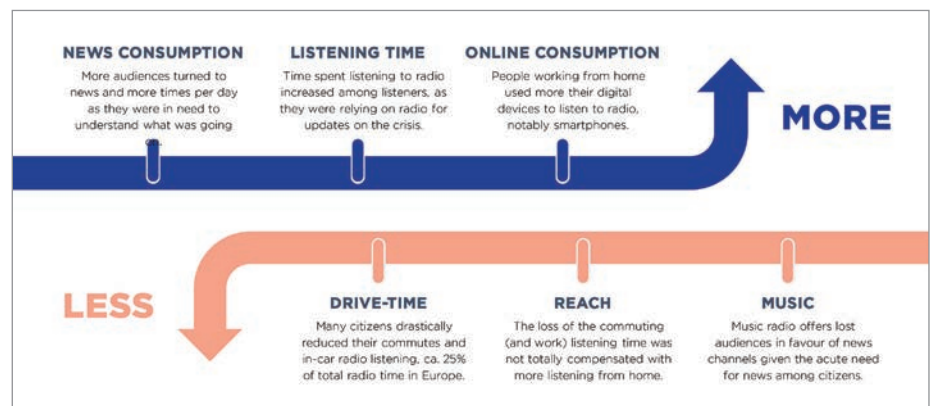
Radio is a very stable medium with a loyal audience. The pandemic, however, has shown some of the limits of that loyalty. To start with, with most of the population working from home, linear radio lost its traditional peaks during commuting hours. As the number of people commuting fell dramatically, so too did in-car radio listening, which typically represents around 25% of total time spent listening to radio in Europe. In fact, peak times moved forward around one hour.

Some of those radio listeners in the car started listening from home but many of them did not transition to their home device, in some cases because there is no such device. Data from Edison Research in the US shows that the number of households *without* a radio device is increasing each year, which means that for many people, the tuner in their car is their natural entry point to radio.

SHIFTING PLATFORMS

Of course, not having a traditional radio set at home should not be a problem for listening to radio on a continent with widespread internet connectivity. Indeed, stations across Europe reported double digit growth for their internet streams.

However, this was not an increase in radio consumption but a change in the platform used to access radio. Our own estimates are that online listening is usually about 10% of total listening, versus 90% broadcast. That 10% may have increased dramatically during lockdowns thanks to ubiquity of connected devices, notably smartphones. Detailed data from EBU Members show that the COVID-19 crisis caused a twofold increase for



Source: EBU based on Members' data from 15 organizations for news apps (all apps for SR) and 20 for news content websites. Average daily visits/sessions for apps and visitors for websites for March 2020 versus January-March 2019

their news apps and websites, the content demanded the most in this period.

RECONSIDERING PRODUCTION

All this fantastic output has been produced in many cases by journalists, producers and technicians that did not have access to their usual facilities. The use of domestic technology, usually thought not to have the required quality, was considered good enough in these highly atypical circumstances. The value of flexibility increased under difficult conditions and made some organizations move further in their digital transformation in a few weeks than in the last few

years.

With many broadcasters already back in their buildings, it will be interesting to see the extent to which those reactive crisis management processes consolidate in the long term. Beyond the technical possibilities, the crisis may have impacted more deeply on the culture regarding technology within radio stations.

The above insights are drawn from the recently published EBU Media Intelligence Service report "Public Radio Response to the Pandemic".

See: ebu.ch/publications/research

Conference videos on demand

A selection of recent additions to our rich library of videos from EBU Technology & Innovation events, available to Members from: tech.ebu.ch/presentations



RIST AND SRT - BASICS AND TEST RESULTS

SONJA LANGHANS AND ANDREAS METZ (IRT)

Comparing two protocols for low-latency video transport



SUSTAINABLE EQUIPMENT AND EQUIPMENT ROOMS

MIKE ELLIS (BBC)

Practical measures to reduce energy consumption in server rooms.



RTVE ARCHIVES: PRESENT AND FUTURE

ROSA ARIZA (RTVE)

Just one of the presentations from the roundtable on archives workflows

IN THE SPOTLIGHT

Emily Dubs

HEAD OF TECHNOLOGY, DVB PROJECT



WHAT ARE YOUR CURRENT RESPONSIBILITIES?

I became DVB's Head of Technology in January 2020. It's a wide-ranging role but always aligned with DVB's general objective to ensure that the standards evolve in a way that is valuable to our Members and is in line with the industry's needs. Some of my daily activities include facilitating the work of the various working groups, representing DVB at promotional events, or organizing demonstrations or workshops with our Members.

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

I would be tempted to say that I am proud (and delighted!) to be now part of the great DVB team, but if I look further back, I see several nice projects where I played a part: the set-up and launch of the first French HD DTT multiplexes, the DVB-T2 roll-out in several parts of the world, and the conception and market introduction of innovative products.

WHAT ARE YOUR PREDICTIONS FOR MEDIA TECHNOLOGY IN THE FUTURE?

The next wave of innovation will be catalysed by a confluence of trends, themselves influenced by technological innovations. Among the many possible paths to be explored, the most obvious trend is the rise of big data which, together with progress on cloud applications such as edge computing, will enable AI to proliferate through all

industries, including media. Our industry has been shaken for a while by the internet and the subsequent major shift in TV consumption; and it is offering more and more possibilities for personalization, feeding the shift itself. I would expect that AI will bring a great deal here, making personalization a more tailored and valuable experience for the end users and thus a more profitable concern for broadcasters.

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

Finding their way in this ever-evolving landscape! Users' expectations are increasingly turned to personalization, which, by its nature, differs from a broadcaster's core competencies. And this trend towards the consumption of either customized or new types of linear content will become more concrete as digital natives gradually represent most of broadcaster's user base.

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

Here is another ever-evolving landscape... I used to be keen on varied fields such as horse riding, diving, windsurfing. Now, mountain hiking is better matched to today's constraints and perfectly fits with my new surroundings. I am also particularly interested in psychological sciences and... technology!

MEDIA CYBERSECURITY SEMINAR

AN EBU EVENT

SHAPING A MORE SECURE
MEDIA INDUSTRY



20 - 21 October 2020, online

<https://tech.ebu.ch/events/mcs2020>

F(IO)RECAST

AN EBU EVENT

MAPPING CHANGES IN
MEDIA DISTRIBUTION



24 - 25 November 2020, online

<https://tech.ebu.ch/events/forecast2020>

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

tech.ebu.ch/events

EBU