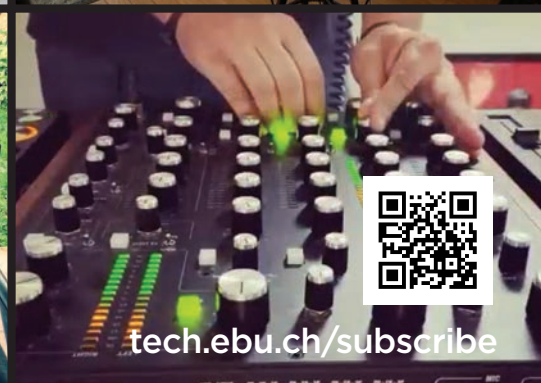
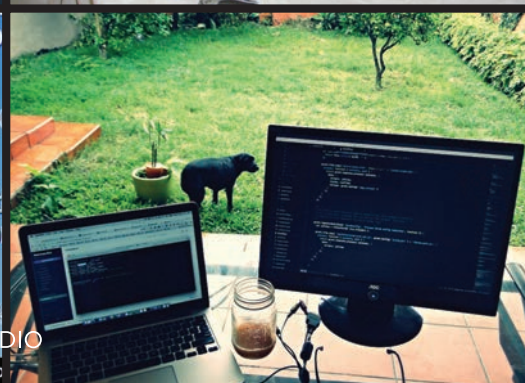
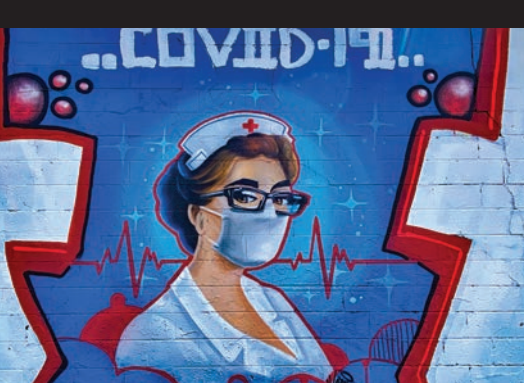
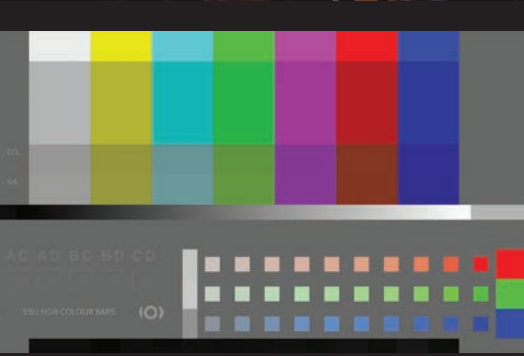
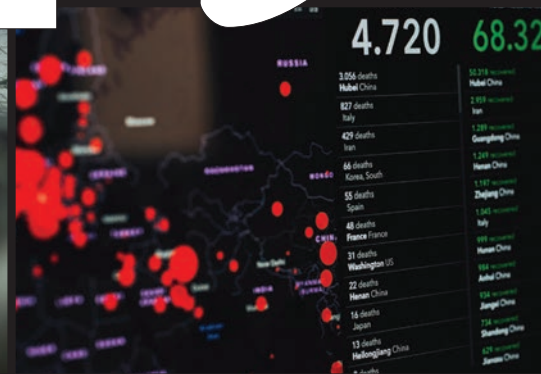


tech-1



Cover story: On pages 10 and 11, strategy leaders from four EBU Members share some initial reflections on how the COVID-19 crisis will impact on PSM and technology in the medium term. Our cover features some snapshots evoking the first weeks of the crisis.

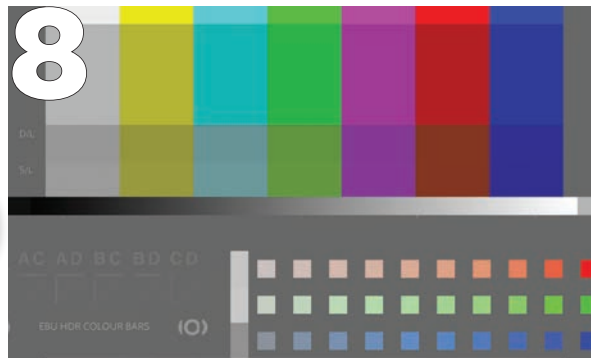
Top left to bottom right: screenshot from a video by Loy Ramirez, Eurovision Labs Madrid; Bram Tullemans, co-host of EBU BroadThinking 2020 online; work-from-home coffee (Allie on Unsplash); behind the scenes at a remote production of RTL Direkt; reporter with mask (Adobe Stock); COVID-19 statistics (Markus Spiske on Unsplash); the new EBU HDR colour bars; social distancing at France Télévisions (Rodolph Chapeau); Hemini Mehta, co-host of EBU BroadThinking 2020 online; detail from mural in Chicago by @milt1coronado (@urbanmuralhunter, CC BY-NC-ND 2.0); Love Bergström, traffic reporter at Sveriges Radio (Elin Jensen); NCD Alliance media briefing (Tedward Quinn on Unsplash); Good Friday in St. Peter's Square, Rome (rdb466 on flickr, CC BY-SA 2.0); home studio (master78 on flickr, CC BY-NC 2.0); RTL Direkt remote production; WHO Director-General Tedros Adhanom Ghebreyesus (screenshot from press briefing); work from home (josoroma on flickr, CC BY-ND 2.0); screenshot from video by Guillaume Jumelet (DJ Mosta).

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We must keep reaching our audiences

Antonio Arcidiacono, Director of Technology & Innovation, EBU

The COVID-19 crisis has sternly tested the ability of public service media (PSM) to fulfil its basic remit. The need for information, education and, yes, entertainment is greater than ever. With trusted brands, universal access and experienced staff, EBU Members have been at the forefront of the effort to help society understand and come to terms with this ongoing challenge.

In this issue of *tech-i*, strategy leaders from several EBU Members have shared some initial reflections on the likely medium-term changes to how their services are produced and distributed (see pages 10–11). For my part, I believe there are some things we can say with certainty, looking again at those key pillars – inform, educate, entertain – but also an overarching aspect that *must* be prioritized as we move beyond the initial shock of this pandemic.

RELIABLE INFORMATION

As the crisis reached Europe, the need for citizens to receive accurate and timely information became quickly apparent, throwing into sharp relief our ongoing discussions about the networks and infrastructure used to distribute media. It is starkly obvious that no single infrastructure can provide access to all essential services everywhere.

Whether for daily news or for urgent emergency alerts, we require reliable and sustainable communication and media distribution infrastructure. Broadcast and multicast, the latter with local storage capabilities, are essential elements for being able to reach 100% of the population on *100% of the territory*. While less of an issue for fixed applications, where fibre optic networks are available, it becomes critical in mobility, where the use of a



unicast-only strategy is unsustainable in terms of economics and resources.

INTEGRATED EDUCATION

Turning to education, we have seen a large-scale experiment in home-schooling, where public broadcasters have quickly stepped in to provide new programming, often leveraging content from their huge audiovisual archives. Seamlessly integrating with national curriculums, EBU Members have opened a fresh path to a new hybrid model for school, where physical classes can be complemented by content from PSM. This experience should not be just a temporary one but should be the basis for a positive by-product of this crisis, contributing to the development of future European citizens.

We are also seeing a whole generation of students gaining an accelerated understanding in the use of interactive audiovisual tools. Tomorrow it will be even

more natural to train young generations to create and produce multimedia content and services themselves. PSM can play a role here, guiding these new creators and moderating the communities that will emerge.

REIMAGINED ENTERTAINMENT

And thirdly, to entertainment. We have each experienced the impact of “de-socialization” on human behaviour. Social interactions have been reduced to a minimum and are mediated as a virtual experience behind videoconferencing tools. We have learned to live with virtual events and won’t go fully back to where we were before. There is certainly an opportunity to reimagine here, offering smaller-scale distributed community entertainment.

When it comes to large events, the key ingredient to attract a mass audience will be the social dimension, that needs to be translated into a collective virtual experience. Previous attempts to transpose a physical experience – think about virtual museum visits – have not been successful, owing partly perhaps to limited image quality, but mostly because of the total absence of a social experience. These considerations should stimulate reflection around new entertainment models that could replace or improve the collective and social experience.

However, perhaps most importantly, all this informing, educating and entertaining will be for nothing if we cannot *reach the audience!* We need to keep this uppermost in our minds, both ensuring that we pick the right mix of technologies to distribute our content and that the commercial arrangements ensure PSM are not beholden to gatekeepers. The crisis is creating opportunities for EBU Members, but we must ensure we are positioned to take advantage.

Eurovision Flow expands reach

The EBU has selected cloud provider Leaseweb as the preferred distributor for the Eurovision Flow multi-CDN solution. The agreement will accommodate the growth of the service for online distribution. Leaseweb also contributes to the technology stack and will take care of technical support.

Eurovision Flow started life in 2016 as an EBU multi-CDN proof of concept, which grew into a full operational service. By aggregating demand, the EBU continues to bring scale advantages to its membership and reduce costs for online delivery. As of 2020, Eurovision Flow has outgrown its start-up office, with an increasing user base from within and outside the EBU membership. With the new partnership in place the Eurovision Flow brand can expand further.

Eurovision Flow load-balances playout requests from online users dynamically over several content delivery networks (CDNs), optimizing Quality of Experience. It is a fully automated redundant system, as traffic is redirected to the best performing CDN while stacking their capacity. It has proven to be ideal for reaching worldwide audiences and is often combined as an offload mechanism with its users' own CDNs. Aside from providing a worldwide sales network, with offices in the Netherlands, the UK, Germany, the USA and Singapore, Leaseweb adds a new multi-CDN management layer that enhances the Quality of Service.

**EUROVISION
FLOW**
OPERATED BY EBU

Powered by  leaseweb

Find more information at eurovisionflow.com and, for EBU Members, tech.ebu.ch/flow.

Bram Tullemans, who co-hosted BroadThinking 2020 with EBU colleague Hemini Mehta



Plan B for BroadThinking

The agenda for the EBU's BroadThinking 2020 conference covered the usual landscape of online content delivery, players and platforms, with an understandable focus on how the infrastructure and services might perform during the period of widespread confinement.

As for all T&I events, the presentation videos are available on demand to EBU Members and those who attended the event: tech.ebu.ch/broadthinking2020

As it became apparent early in March that COVID-19 would quickly and severely limit the scope for international travel, the organizing team for BroadThinking realized a Plan B would be required. EBU staff had already switched to working from home, so everyone quickly focused on the necessary pivot to holding – in the third week of March – the EBU's first entirely online conference.

AN EBU FIRST

While the live streaming of events has been the norm for several years, this would be the first time that an entire conference was held online-only, and with the presenters distributed across the continent

and beyond. The event, free for EBU Members and with a nominal fee for non-members, attracted more than 200 registrations and maintained a steady attendance of at least 120 people throughout.

Despite one or two small technical glitches, the conference ran smoothly, with the usual high-quality presentations and high-value conversations, albeit mostly moderated through the online Q&A interface. Indeed, the biggest challenge was how to bring the all-important networking aspect of such events into the virtual domain. Having more social interaction can take an online conference to another level and it remains an area for further experimentation.

The event served as a valuable testing ground for running EBU conferences and large-scale meetings online. The weeks since have seen a whole raft of successful events, from webinars and roundtable discussions to annual assemblies and conferences. Both the **MDN Workshop (9-10 June)** and the **Network Technology Seminar 2020 (23-24 June)** will be online-only events.

See: tech.ebu.ch/events

An unprecedented test for distribution infrastructure

As the COVID-19 crisis took hold in Europe, writes **Peter MacAvock (EBU)**, the resilience of broadcast and broadband networks was put to the test. These are unprecedented times. EBU Members have all stepped up to the challenges, including the rapid imposition of working-from-home, the provision of regular and reliable news to their audiences under difficult conditions, and so much more. But how has the infrastructure for broadcasting and broadband held up to this challenge?

The stay-at-home orders across Europe provoked a rapid shift in consumption patterns. Public service media saw a sharp rise in their ratings, a demand for regular reliable information and a rapid change in programming, as the sports schedules collapsed while demand for educational content surged.

With governments fearing that internet networks would be overwhelmed, Netflix and other OTT providers were asked to respond and did so by reducing the bitrates served to their surging audiences by around 20%. This was accomplished by removing the top quality tier in their adaptive streaming manifests. Thus 4K became

HD and so forth. But would this alleviate congestion on the networks so many rely on to enable working and education at home? And what help could the broadcasters offer in addition?

EBU RECOMMENDATION

The EBU produced R 149, a technical recommendation on how to mitigate congestion on broadband networks. Its main provision is local dialogue, which was largely underway in EBU Member markets already. EBU Members are uniquely placed to mediate between the stakeholders in broadband distribution, being heavy users of internet infrastructure, trusted brands, and experts in local market conditions.

Behind the dialogue are a few facts emerging from the COVID-19 crisis. The expected congestion of internet infrastructure has not manifested itself. OTT providers dropped their top tier of around 15mbit/s to 8-10 Mbit/s in some cases. Even without this, the broadband infrastructure has proved remarkably resilient.

R 149 notes, nevertheless, that the fixed-line infrastructure, which tends to serve the biggest screens, has been more resilient than the mobile networks. Thus,

quality limitations might be more appropriately applied to streaming manifests that target mobile devices, while maintaining high quality on large TV screens.

When considering congestion and – let's face it – the costs, EBU Members typically measure their broadband traffic at four points: CDN outputs (remember that pricing is linked to capacity usage at this particular point); the Exchange peering point between EBU Members and different ISPs; the last mile between broadband hubs and the individual's home; and the individual household infrastructure. EBU analysis has pointed to the last point as being the most critical in many cases.

But, I hear you say, EBU Members are fundamentally broadcasters. What of broadcasting? Surely it is immune to the congestion that can afflict the internet? As EBU Member ratings soar, broadcasting is the ideal way of reaching large audiences and indeed it does work very well.

EBU Members are at the forefront of addressing the challenges posed by this unique situation, and we're learning all the time. If we write this article in six months' time, it might look quite different.

Collaboration on speech-to-text benchmarking

A new open source benchmarking tool eases the task of assessing which speech-to-text (STT) system is most suited to a given use case. Created in response to requests from the EBU membership, BenchmarkSTT can be integrated in production workflows to enable objective comparison of the performance of different Machine-Learning-based STT systems.

For media organizations, automating STT services can deliver huge efficiencies when it comes to accessibility services or leveraging audiovisual archives.

The process of choosing a commercially available STT tool or developing one in-house can benefit from the comparisons that BenchmarkSTT enables.

The tool was developed by the Flemish Institute for Archiving (VIAA), BBC, France Télévisions, the Rai (Italy), Sveriges Radio (Sweden), SRG SSR (Switzerland) and others gathered under the EBU umbrella.

For the code, documentation, and a step-by-step tutorial, see: github.com/ebu/benchmarkstt

Color key: Unchanged Reference Hypothesis

·the·reference·hypothesis·transcript

Making radio smarter and more social

Integrating broadcast radio with digital and social media was the goal of a recent project involving EBU Members in Belgium and the Netherlands, writes **Mike Matton**, head of international R&D collaborations at VRT Innovation.

MARCONI is a European Horizon 2020 project that aims to offer fully interactive and personalized radio solutions. As project partners, both VRT and NPO have experimented with innovative new approaches.

CHATBOTS FOR RADIO

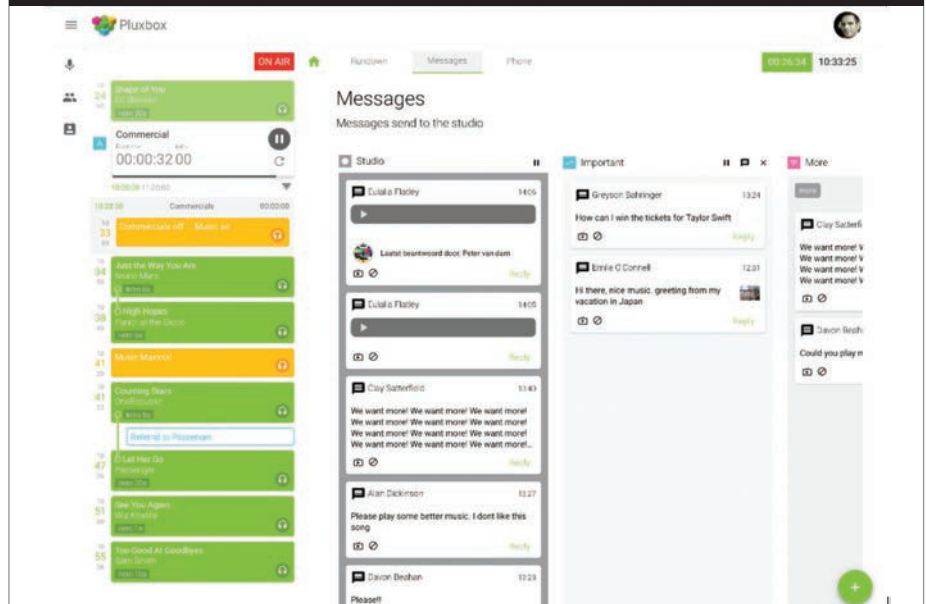
NPO has organized various pilots under the framework of MARCONI, including one on the use of chatbots for radio, together with consortium partner Faktion.

Listeners to NPO Radio 5 were able to inquire about different radio shows (schedule, content, presenter), DJs, songs and competitions. More general questions were also welcome. Using a smart connection with the station's editorial system, questions about programmes, songs and DJs could be automatically answered, as all the information was already available. Another chatbot was developed for a large Dutch charity event, called Serious Request.

The goals of using chatbots were to engage listeners in a programme and to entice them into donating money or setting up events, as well as providing an additional service to web visitors.

The main learnings were that you should start off small with a simple conversation and then elaborate step-by-step. It is labour-intensive work to prepare the chatbot, and to monitor and adjust it at the same time, so you need enough editorial capacity. It is quite a steep learning curve to create a well-functioning chatbot, so you need an expert or a specialized company, which was the case for NPO. You also need to make it very clear to users what they can expect, and guide them into using the chatbot in the right manner. Events seem to be a good use case for chatbots,

The VRT/Pluxbox integrated radio production system



to handle frequently asked questions.

As a conclusion, in this case the chatbot was mainly successful as an additional service, but much less as an instrument to incite a certain behaviour, like donating money.

SMARTER INTEGRATION

In winter 2019, VRT Innovation held a radio-focused hack week. Several VRT departments worked with technical partner Pluxbox to prototype a proof of concept (PoC) combining key radio applications – rundown, phone and chat, playout – in an integrated production system.

There were three aims. Firstly, they wanted to gain insight into how fully the playout system features would function via API integration, especially in a live situation. Secondly, they wanted to test whether it's possible to build a highly modular system that can easily be tailored to a radio station. Finally, they wanted to find new use cases that might arise from the integration of the main building blocks of live radio.

To fully focus on front-end prototyping during the hack week, a lot of preparation was done beforehand. They organized a UX-focused workshop to get an idea of the important front-end elements and carried out observations at three VRT radio stations (MNM, Studio Brussel and Klara) to really understand what is used and needed while making radio shows.

The hack group was split into two teams. The first focused on user research and front-end design. They created clickable mock-ups and wireframes and gathered feedback from radio producers. The second set up the technical environment and implemented the mock-ups in a working PoC.

At the end of the week, the PoC was presented to a large group of radio producers and technicians. They have since proceeded towards preparing this prototype for actual radio productions and refining it further in real studio environments.

See: www.projectmarconi.eu

An intelligent approach to capturing and using radio metadata

Chris Roberts and **Luke Eldridge**, who work on content production workflows at BBC Design + Engineering, explain how a metadata project called Fenchurch is feeding the ultimate goal of improving the audience experience.

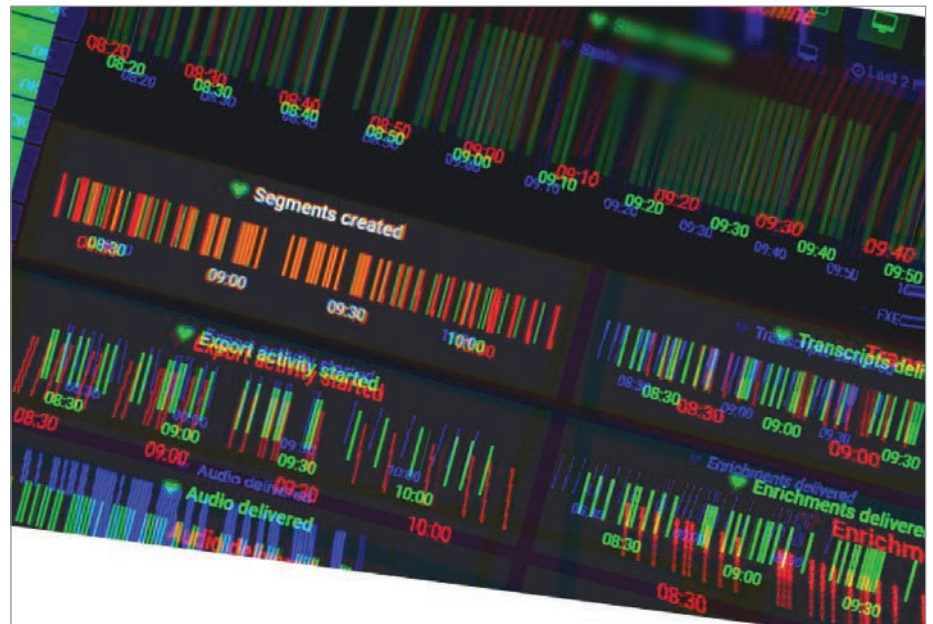
We are always looking to improve the ways in which we create and distribute audio content to the audience. The amount of metadata required to provide compelling audience experiences can be large and there are limits to the resources that are available to do this. How can an organization with such a vast audio catalogue – 57 hours of new material is added to that catalogue *each hour* – keep up?

The answer lies in harnessing the power of automation and artificial intelligence. BBC Design + Engineering is building systems that do the heavy lifting so that production staff don't have to. One of the first of these systems has been developed by the Internet Fit Radio team. It is called Fenchurch.

TAGGED FOR BBC THINGS

By using speech-to-text, natural language processing and linked data, Fenchurch is able to break a programme into segments and tag each one with a BBC Things tag. BBC Things is a single source of reference for the growing collection of entities – people, places, organizations and events – that matter to the BBC and its audiences. Having the segments appropriately tagged allows them (and the programmes from which they come) to be searchable, discoverable and available for curation.

By integrating with systems further up the broadcast chain (i.e. studios and production systems), Fenchurch is able to gather much more information about how a programme was put together than would be garnered from simply looking at the broadcast output. A blend of AI and standard data integration is used to deliver the best



quality possible with the best value. For example, avoiding the application of speech-to-text processing on music, or music genre detection on speech content.

A segment in a programme could be several different kinds of content: a news bulletin, a story within a bulletin, a music track, or a section of the programme where an interview is taking place. Each of these segments can be tagged with concepts (e.g. this interview is about climate change), but also have other properties that describe it, such as pace (relaxed or excited) or valence (joyful or angry). Each tag or property allows this segment (or the programme in which it resides) to be discovered by the audience with greater ease. It lets the audience find what they are looking for, whether they are searching by topic, or being presented with content that has some relevance to content they've already shown an interest in.

ANALYSING CONTENT

The plumbing that Fenchurch provides could also be used to analyse content in different ways, for example *sentiment analysis* for speech or *genre analysis* for music. As new research is carried out, new analyses can be tested with live data to see how they perform.

Currently, this system is running 24/7 on one national BBC radio station, with a wider roll-out coming soon.

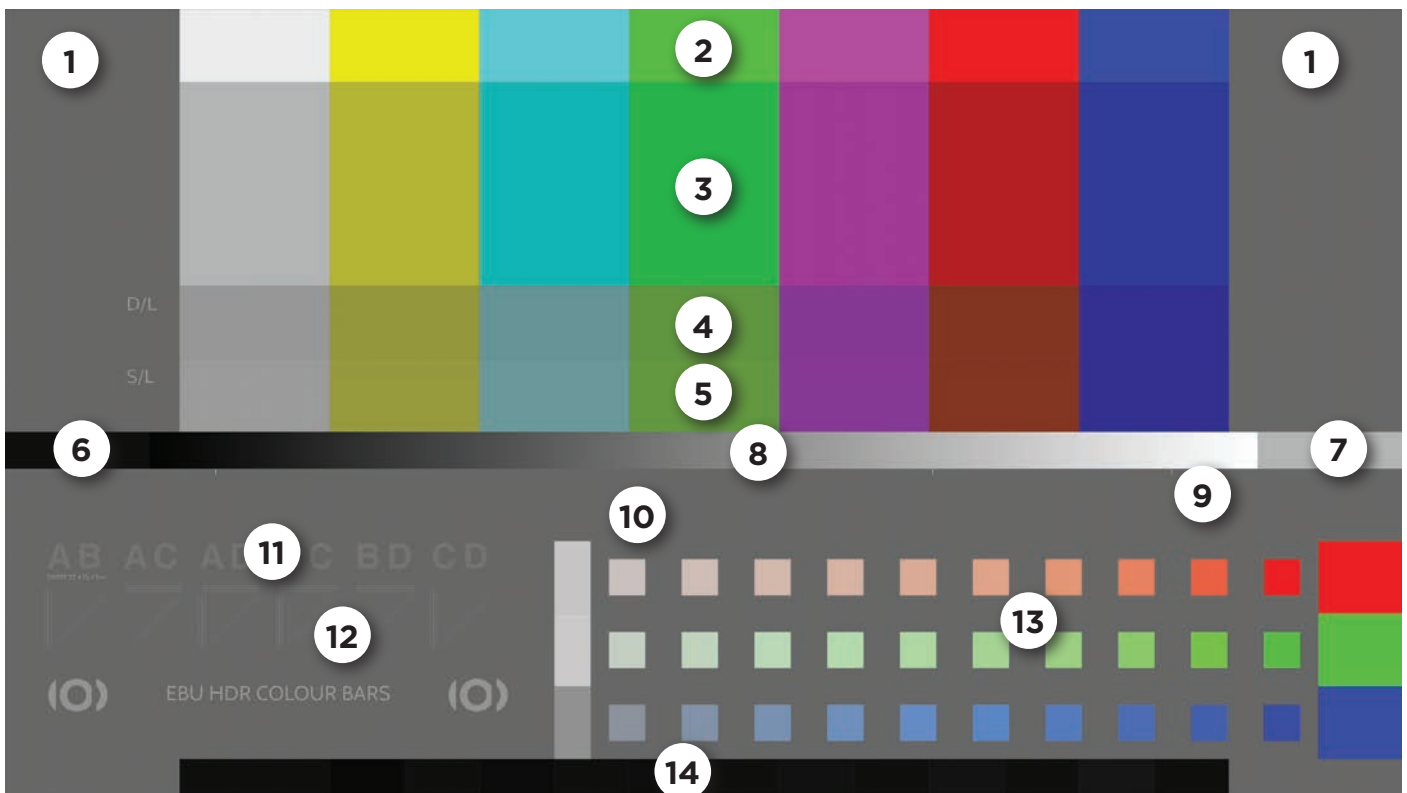
The metadata generated and captured by Fenchurch will be used to improve the audience experience when listening to audio content and aid the discovery of new content about the things they love.



Fenchurch

Cheat sheet for the new EBU HDR Colour Bars

The family of EBU test patterns now includes a new member: UHDTV Hybrid Log Gamma (HLG) Colour Bars. These bars were designed for use in high dynamic range (HDR) production environments. EBU Tech 3373 provides the details. The main features are outlined below. The bars are available in the 2160 and 1080 raster format. You can download TIFF and v210 versions of the new colour bars from tech.ebu.ch/publications.



- 1 Space to add your own branding
- 2 100% HLG bars to test HDR levels are correct
- 3 75% HLG bars to test HDR levels are correct
- 4 Bars that show as ITU-R BT.709 75% bars when display-light is converted to SDR
- 5 Bars that show as ITU-R BT.709 75% bars when scene-light is converted to SDR
- 6 Area at minimal nominal video level (0%)
- 7 Area at reference/graphics white (75%)
- 8 Linear luma ramp from sub-black (-7%) to super-white (109%) to confirm the chain is monotonic and linear, and that there is no clipping
- 9 Marker at the maximum nominal video level (100%)
- 10 Text area (e.g. production title)
- 11 Letters to check if a cable is missing when producing in UHD over 3G-SDI (2SI)
- 12 Patterns to check if 3G-SDI cables have inadvertently been swapped or are missing
- 13 Saturation test signals that help to estimate which colour gamut a monitor can reproduce
- 14 Near-black test signal (-4% to 4%) to check monitors and if sub-blacks are maintained in the chain

Looking at UHD TV codecs with expert eyes

With UHD and HDR driving the availability of new production codecs, **Dagmar Driesnack** (IRT) describes how the EBU and its Members collaborate to assess how well they perform.

Video production equipment uses different codecs and settings to balance competing requirements on power consumption, speed, cost, bitrate and quality. Cameras and video editing systems have traditionally been influential in popularizing specific formats. Although file-based workflows have provided more liberty to choose the best codec for the job, the introduction of UHD TV and HDR are making the choice harder again.

To help its Members evaluate the visual quality of new video production codecs, the EBU organizes expert viewings, with vendor representatives present as observers. The last series of such tests concerned HD material with standard dynamic range, but the advent of UHD resolution and the availability of HDR (high dynamic range, via the HLG and PQ variants) gave rise to the need for new tests.

Thus, the EBU Video Systems groups set out to organize a week of testing at the beginning of this year. The viewing sessions were hosted in Munich by the IRT, which organized them together with the German *UAG Beyond HD/Produktioncodecs group* (ARD, ZDF, ORF, SRG).

WHAT TO TEST?

One key question was what exactly to test. The simple act of choosing between the typical options for the three main format parameters – resolution (1080p or 2160p), dynamic range (SDR, HLG or PQ) and frame rate (25, 50 or 59.94 frames) – already generates 18 possible combinations to test*. It is also a challenge for manufacturers to develop codecs for all different uses, and unrealistic to cover them with a single codec. Each manufacturer therefore typically



Frank Hlawitschka and Sandra Groß (both WDR) taking a much closer look during a break in the tests

provides a set of codecs, arranged in codec families. With these come further choices, such as bit depth, colour sampling, transfer functions, and coding type (long GOP or I-frame only).

Based on the plans revealed at IBC2019, the EBU Video Systems group identified more than 200 (!) possible combinations to test. After a voting round by EBU Members, 45 of these were selected for actual testing. It should be noted that the focus was on real-world products, not laboratory prototypes. Therefore, vendors were asked to send products implementing Apple (ProRes), Avid (DNxHR), Panasonic (AVCUltra) and Sony (XAVC) codecs to EBU HQ and Members' facilities, where the coding of the test sequences took place. The coding used high-quality video material with varying complexity. Seven generations of video were encoded, bringing the total to 315 sequences! The PSNR (peak signal-to-noise ratio) of all sequences was calculated and the 1st, 4th and 7th generation

of each sequence was scored by the expert viewers participating in the testing.

RESULTS PUBLISHED

The production codecs tested performed impressively during the expert viewings. Detailed test reports for each codec family are available to EBU Members as EBU BPN 121 to 123 (see tech.ebu.ch/publications). A supplement describes the test procedure in detail. The fourth report is to be published later.

There are already plans for further EBU codec tests. If the COVID-19 situation allows, these may include testing of mezzanine codecs in IP facilities. There are also plans to look at the actual codec performance range of the same codec in different devices, as device-specific configurations are sometimes used and may alter the base codec's performance.

** Note this is already a restricted set, as it leaves out additional frame rates and the '8k' (4320p) resolution.*

COVID-19: a disruptor and an accelerator

We invited strategy leaders from the EBU membership to share some early reflections on the likely medium-term impacts of the COVID-19 crisis on how public service media use technology. Here we feature views from Belgium, Canada, Finland the UK.

Peter Archer

CONTROLLER, PORTFOLIO STRATEGY, BBC (UK)

The COVID-19 pandemic will bring a number of lasting changes to how public service media (PSM) organizations think about and use technology. In particular, I think we will all be significantly more reliant on communications technology, be it video conferencing or collaboration software. Many of us could yet be working away from HQ for months; these technologies have already demonstrated their value in supporting more agile ways of working in the longer term and being embedded in business as usual. The challenge will be to change our ways of working to make the most of them post-pandemic. We've also seen production technology used in new ways to great effect - enabling new creative ideas and more efficient ways of working.

More broadly, though it's too early to draw firm conclusions, I expect the pandemic to accelerate the uptake of online services, particularly VOD services, across all age groups. This means the online products of PSM organizations (and



Peter Archer

underlying capabilities like content and data management) become even more mission critical.

In the longer term, one lasting effect of COVID-19 and the likely ensuing recession, may be the strengthening of technology giants like Amazon, Google and Apple, who are not only well placed to weather the economic storm, with significant cash reserves, but are able to cross-promote and cross-subsidize their services to cash-strapped consumers.

(Much) more speculatively, the rise of consumer video-calling that we have seen during the pandemic could lead to an increase in high quality cameras in the living room (e.g. to enable video calling via TV). This itself could create the necessary long-term conditions for computer vision technology, with implications for the sorts of content we make and how audiences interact with television programmes.

Mika Rahkonen

HEAD OF STRATEGY, YLE (FINLAND)

It turns out you can do anything from anywhere - but that's not enough.

An overarching theme has been that people working for Yle can do pretty much anything from anywhere: people can participate in radio talk shows from their living rooms via an app; another app means that people can record video interviews wherever they are; people can make multi-camera television productions remotely using a distributed model. We even built a church inside a television studio to be able to broadcast a religious service.

I'm sure these *digital leaps* are the case everywhere.



Mika Rahkonen

A lot of media companies take great - and deserved - pride in having been able to maintain all of their operations almost unaffected by this emergency if you look at those operations from the outside. Now that IS a remarkable achievement.

But there's something more. And, as is often the case, the tech issues are more than tech issues. With all our hands pretty much tied to the daily, weekly or monthly operative stuff, we need enough time and space (very, very preferably face-to-face) for innovation and new ideas, both great and silly; and not just for the present moment or the near future but years from now. Otherwise, we will see those digital leaps done around us but not by us.

Dan Boudreau

EXECUTIVE VICE-PRESIDENT OF MEDIA TECHNOLOGY AND INFRASTRUCTURE SERVICES, CBC/RADIO-CANADA (CANADA)

The New Maison de Radio-Canada (or the NMRC as we call it) will be our new innovative, eco-friendly broadcast centre in Montreal, scheduled to be fully operational in 2021. It will be



Dan Boudreau

home to roughly 2,600 CBC/ Radio-Canada employees upon completion.

Despite COVID-19, we needed to ensure that the project kept moving forward.

Even with very few people on site, our project team has been able to quickly reconfigure pre-installed equipment to allow remote-controlled operations – a tangible benefit of the flexibility and agility brought by IP and IT technologies in the NMRC. These remote capabilities include streaming any real-time audio/video signal from the building. This has allowed engineers and technicians to continue configuring systems and to see the result of their actions, in real time, while at home. It is yet another reason that IP technology was the way to go, and we will be one of the first in the industry to implement end-to-end ST 2110 IP broadcast technology in a multiplatform (TV/Radio/Digital) facility.

The broadcast industry is going through a digital transformation, and COVID-19 is accelerating this change. We've seen a significant increase in our market shares, but most interestingly we have had a steep increase in how many Canadians access our online platforms every day. Social behaviours are changing and the IP technology we are setting up at the NMRC is positioning us well to take that challenge head-on.



At VRT, the adoption of game engine technology enables the creation of virtual environments, opening new possibilities for creating high-quality content from home.



Tom De Wispelaere

Tom De Wispelaere
HEAD OF TECHNOLOGY
TEAMS, VRT (BELGIUM)

VRT had already come a long way on its digital transformation journey. This enabled us to adapt even our most critical processes to the COVID-19 crisis, prioritizing the wellbeing of our staff and business continuity. And like most organizations, our people have experienced a crash course in setting up their VPN and organizing videoconference meetings from home.

Not surprisingly, the disruption of COVID-19 has also caused an acceleration in changes that were already underway and will continue to have an impact as we prepare our move to the new VRT building.

Collaborative remote video editing and playout have been enthusiastically embraced by our users and have become the de facto standard for VRT. Remote

working has also placed even more emphasis on having the right IT security measures in place and educating people on best practices.

Our viewers and listeners are, now more than ever, looking for reliable content from trustworthy sources. The importance of analysing data to make sure we are optimally fulfilling this need has never been more apparent. Tools and formats facilitating user participation in public debate through civilized conversations will further increase in importance to ensure connectedness and trust, and to counter the growing digital divide. Moreover, COVID-19 has effectively demonstrated the added value of data visualization as a powerful tool to tell good stories from big data.

The crisis has also helped us re-evaluate the ways in which technology can drive us as an organization. Editing in the cloud, the integration of cloud services and storage, and the fundamental shift towards virtualization in almost all aspects of our business make even more sense now.

And virtual production pipelines and virtual sets, through the adoption of game engine technology in our broadcast environment, are exciting examples of how immersive technologies can start to augment our productions and allow our creative people, even working from home, to deliver content with high production values in a post-pandemic world.

The four keys to connecting with Gen Z through immersive journalism

Research funded by Spain's RTVE has identified quality, authenticity, immersion and ease of consumption as the keys to successful immersive journalism, write **Beatriz Gutiérrez-Caneda**, **Sara Pérez-Seijo** and **Xosé López-García** (all of Universidade de Santiago de Compostela).

Members of Generation Z are the present and future target audience for media organizations. These young digital natives demand high-quality multimedia products, are interested in a disparate range of topics, and also expect intuitive and fast consumption of content. In the case of immersive journalism, they especially value what brings authenticity and truthfulness to the story.

Virtual reality (VR) and other immersive technologies are increasingly used in fields as diverse as video games, onboarding campaigns, cultural activities and by NGOs. And journalism is no exception. Since 2015, the use of 360-degree video and VR to create news has grown continually, leading to the development of a whole new screen grammar.

Many media are producing 360-degree reports and documentaries and factual VR reconstructions, with the aim of allowing users, rather than passively watching a story, to gain first-hand experience as a witness to unfolding events. Thus storytelling becomes “story-living”.

GROUP STUDY

Our research focused on how Gen Z (people born around 1994–2011) consume 360/VR content. The aim was to identify potential weaknesses, but also strengths and future lines of action. We conducted an experimental study with 20 participants, aged from 18 to 24. (One of the experiences tested is restricted to people over 18.)

The experiment was conducted in group sessions, with each one having four steps. Users first answered a preliminary questionnaire to determine their

profile. Then they watched the following five immersive experiences using a VR headset or, for the BBC production, a smartphone:

1. The 360-degree video report *Fukushima. Vidas Contaminadas*, produced by the Spanish newspaper *El País*.
2. *6x9*, a virtual reality experience by the British newspaper *The Guardian* (restricted to over 18s).
3. *Cervantes VR* and 4. *Tarraco*, two different spherical video productions published by the public broadcaster Radiotelevisión Española (RTVE).
5. *Hebron: One Street, Two Sides*, a report produced by the BBC, with lower levels of immersion compared with the others.

After that, participants completed a specific questionnaire for each experience, in which they answered several questions related to the consumption process, features and user interface (simplicity, usability, accessibility, physical discomfort, etc.); to technical aspects of the experience (height of the camera, image quality, feeling of immersion and so on); and to the

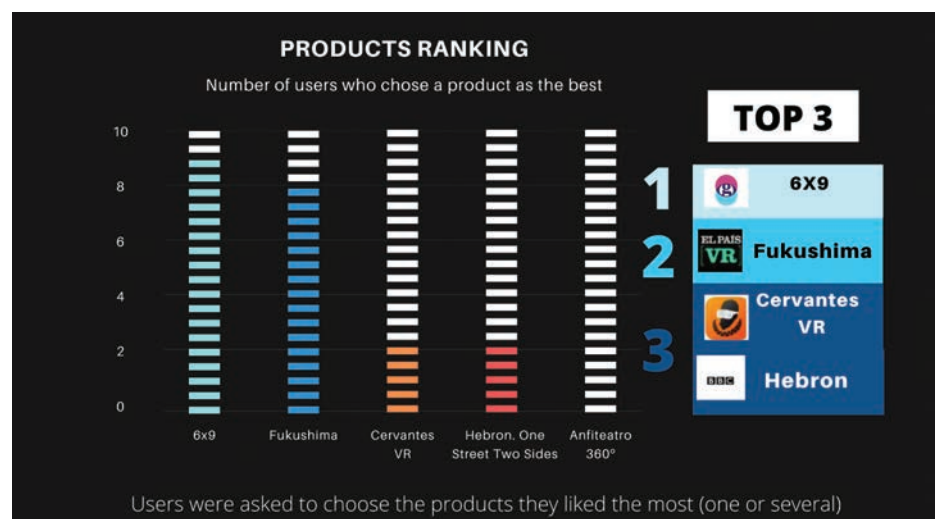
content itself (sensationalism, adaptation of the topic to the format, etc.).

These issues were later discussed in focus groups held after each session, opening up interesting discussions, especially about ethics and immersive journalism.

The group sessions made it possible to obtain significant data for determining the consumption model of these Gen Z users, as well as their perception of and relationship with immersive journalism and 360/VR experiences.

COMMUNICATION FAILURE

Our research identified a set of common weaknesses that hinder the users' awareness of, access to, and consumption of 360-degree non-fiction videos and VR news experiences. Among the most significant, the failure of communication strategies stands out, since only one of the 20 users knew in advance about the products included in the sessions, even though the participants included people from the fields of communication and journalism. Most of the remaining weaknesses identified were



WEAKNESSES		
Communication		Detected in
Communication strategies fail.	Users did not know or had not heard about these products. (Only one person did, because this individual participated in an NGO.)	All the products
Social networking fails.	Users, frequent consumers of content from social networks, did not recall seeing these products on their timelines.	All the products.
Accessibility and usability		Detected in
Major problems of accessibility and usability.	Access to the products is not quick (five clicks) and, in several cases, there is not even a link between the landing page and the page where the product is (requiring users to search on Google). Further, there is not a site search to ease this task.	The great majority of the products.
Need to download a specific app.	The app can be monothematic or can contain diverse content, but either way, users must download it to consume the product. It is distinct from the media news app.	The great majority of the products.
Content dispersion.	Content is not properly tagged and/or there is not a specific section for the immersive products.	The great majority of the products.
Confusion of terms: 360° vs VR.	The confusion between the terms '360-degree video' and 'virtual reality' is very common. Media usually use the concept VR to refer to 360-degree videos.	Some of the products.
Content and format		Detected in
Low quality.	-	Some of the products.
Unrealistic view.	The view is not realistic, so it decreases the user's sense of place.	Some of the products.
Others		Detected in
Problems related to compatibility with specific smartphones.	-	The great majority of the products.
Dizziness and physical discomfort.	This feature depends especially on the user.	The great majority of the products.

Table 1. Weaknesses identified in immersive journalism experiences

related to the usability and accessibility of the websites and apps where the 360-degree videos and/or VR productions are available for consumption.

Table 1 lists the general deficiencies detected in the experiences analysed, deficiencies that can be extended to many immersive products offered at present.

FOUR KEY ASPECTS

Taking into account the users' assessments of the experiences, the weaknesses they highlighted and the conclusions drawn from the discussion groups, we have identified four key aspects that

Gen Z users value the most: quality, ease of consumption, immersion and authenticity.

Quality: Gen Z is used to watching audiovisual products in high definition from a very young age and, moreover, in large quantities, so they do not tolerate inferior quality content.

Easy consumption: precisely because they are digital natives, they find new technologies intuitive, easy, fun and so on. They are impatient and, in the current scenario, saturated with content and information – if they find the

consumption of a product too difficult or complicated, they will just move on to another one. Also, compatibility problems between content and some types of smartphone should be solved.

Immersion: although there is no clear preference for a particular topic, they are concerned about the story that is presented to them. The format serves to provoke an interest in issues that otherwise would not have attracted their attention. Users want to feel part of the story. They value very highly the strategies and resources that boost immersion, such as the use of real images or surround sound, the perspective, or even the audiovisual language used.

Authenticity: again, the story matters and users want to know everything about it and in the most realistic way possible. They are enthusiastic when there are elements such as real videos or images and tend to value less content based on synthetic images.

As a response to these weaknesses identified and to the demands of the users, several lines of improvement have been proposed: the inclusion of more levels of interaction and more gamification logic in 360-degree video and VR content; the use of real images and evidence; boosting the dynamism in the productions; the commitment to new issues with a preference for social topics; and, finally, the improvement of dissemination, access and consumption of these immersive experiences.



This study was supported by a research grant from RTVE as part of its *Impulsa Visión* programme.

Testing times for the Live IP transition

As the global crisis unfolded, the March 2020 JT-NM Tested event was cancelled. Fortunately, writes the EBU's **levgen Kostiukevych**, the test programme for Live IP equipment had already introduced self-testing, so all was not lost. Far from it!

While the transition away from traditional SDI-based production towards IP-based infrastructure has now gained considerable momentum, there is still some way to go before a sufficiently wide range of standards-compliant equipment is available. The JT-NM Tested programme is designed to give prospective buyers – including EBU Members – a view on which IP production equipment supports a range of key interoperability protocols.

In May 2020, we published the third set of catalogues that provide a snapshot of how vendor equipment conforms to key parts of the SMPTE and AMWA NMOS standards. The test plans for this third round had three parts: SMPTE ST 2110, with AES3 audio transport (ST 2110-31) included for the first time; AMWA NMOS TR-1001-1, with the testing of registries and controllers added; and cybersecurity testing.

The impact of the COVID-19 crisis meant that the catalogues, and the related badges awarded to participating vendors, differed from those originally intended.

HOUSTON, WE HAVE A PROBLEM

Recognizing that global interoperability events demand substantial commitments from all parties involved, we saw that self-testing would need to be transparently objective and ideally PICS-driven (protocol implementation conformance statement). There had already been moves towards requiring more self-testing, with a mandatory “pre-testing” exercise introduced for participants in the second round of JT-NM

Tested. This was judged to have been a success and thus a full self-testing regime (covering all test fields, including the cybersecurity testing) was introduced for the third round. The physical gathering would then be used to validate those self-testing results. However, as the scale of the COVID-19 crisis became apparent, we had to act fast and pivot the programme in a short time frame to make self-testing the main focus for this round.

With the cancellation of the face-to-face event that was to have taken place in Houston, Texas during March, the range of what could be validated by the JT-NM Tested team was narrowed. In the absence of a physical event, it was impossible for the expert teams to validate all of the self-testing results and award the resulting JT-NM Tested badges. It was decided to award a new category of badge indicating that the product has been “self-tested according to the JT-NM test plan”.

An exception to this was the testing of NMOS controllers, successfully performed by the team remotely over a cloud VPN solution. This allowed the award of standard “JT-NM Tested” badges for the products that had taken part in these tests.

And so, in May 2020, the ST 2110 and NMOS TR-1001-1 catalogues were published and the badges – both “JT-NM Tested” and “JT-NM Self-Tested” – were awarded to the participating vendors. The publication of a report on the outcome of the March 2020 cybersecurity tests will be considered following a thorough analysis of the available results.



This positive experience demonstrated the promise of adopting a similar approach for future testing rounds and other tests.

At the time of writing, the JT-NM team continues to monitor the global situation closely, with the likelihood that there will be no new iterations of the testing programme in 2020. It will, however, continue to evolve in 2021, with the main accents on the real-world challenges that end users face when deploying large-scale Live IP solutions.

JT-NM is the Joint Task Force on Networked Media. The EBU's partners in the consortium are AMWA (Advanced Media Workflow Association), SMPTE (Society of Motion Picture and Television Engineers) and the VSF (Video Services Forum). See: jt-nm.org

Using AI for smarter, more sustainable video encoding

Jean-Louis Diascorn, senior product manager for compression encoders at Harmonic, explains how AI-based encoding can provide energy and cost savings for video delivery.

A decade ago, power-efficient, green deployments were a hot topic in the broadcast and media industry. New system designs for video equipment were created with the intent to minimize carbon emissions.

Since then, video streaming has emerged, allowing greater flexibility for the end user to choose the video content they want to watch and where to watch it. Yet, as OTT continues to grow in popularity, the energy consumed by video content delivery systems is no longer insignificant. A massive amount of processing power is required to deliver OTT services.

LOW CPU, HIGH QOE

Over the last few years, technology has also evolved in a myriad of ways and offers solutions to improve OTT systems. Software-based video delivery systems have become critical to enabling the rapid launch of new business models.

Reducing equipment density and decreasing the amount of power needed for video service distribution is an important topic again, but new technologies are

now available, especially systems with artificial intelligence (AI) encoding.

AI-based encoding provides several key benefits, including the ability to achieve better bitrate savings, higher quality of experience (QoE), and resource optimization in terms of CPU, power and rack space. Ultimately, with AI compression, performance can be improved more quickly, or with less human resources, enabling the industry to test next-generation use cases that would otherwise be too costly.

USE CASES

AI encoding employs a two-step approach. It starts with an offline learning phase where test files are fed to an offline learning system. The second phase implements the use of the results. After the learning system produces a prediction model, it is then downloaded into the live video delivery system.

The principle is captured in Figure 1.

A key application for AI is dynamic resolution encoding. This approach relies on a

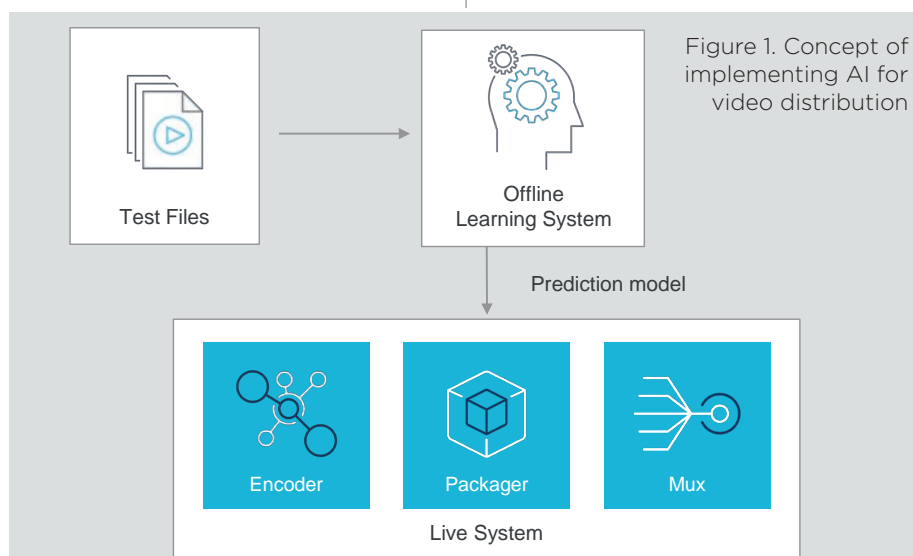
prediction model to determine what resolution is best to encode in order to achieve the highest QoE and CPU savings. Dynamic resolution encoding is especially useful for complex and fast-moving content, such as motor racing.

With this technique, rather than encoding content at the full resolution, for example 1080p at 4 Mbps, video service providers can encode content at 720p using the same bit rate. Dynamic resolution encoding ensures there are fewer artifacts, so the picture quality is better and fewer CPU resources are used. When the movement in a scene is less obvious, service providers would encode at a higher resolution to deliver more detail.

Another application for AI is dynamic frame rate encoding. With this method, encoding is performed at several different variable frame rates (VFR), such as 15 fps, 30 fps and 60 fps. Depending on the content, the AI engine will decide whether to encode at a lower or higher frame rate. On average, the frame rate will be lower than without VFR, resulting in the encoder using less processing power. Overall, this technique has shown to provide about 30% CPU savings.

Dynamic resolution encoding and dynamic frame rate encoding can be combined to optimize bandwidth consumption, QoE and encoding density for streaming and broadcast delivery.

In the future, AI will be used increasingly in encoding algorithms and included in next-generation standards. AI-driven video compression and content-aware encoding promise an exciting and less power-hungry future for video distribution.



A case for capability mapping?

David Wood introduces a management tool that may be useful for your organization.



“You can see more clearly the capabilities that have the greatest impact for your customers.”

Figure 1: The figure shows a simplified structure of a company capability map. The sample boxes lettered A to G would include those things that serve the audience directly, such as programme making and delivery. The boxes above them concern policy decisions. The boxes below them include supporting services such as human resources.

Meet business architects. They are people who, among other things, work out what company architecture is needed to achieve its business model. Some, but not all, organizations include them in their staff. They have their own terminology and management science. One of their tools is the capability map. Believe me, it's well worth investigating.

An EBU Technical Committee group (led by Nick Hopewell, BBC and Jürgen Grupp, SRG SSR) will shortly publish a generalized capability map for public service media organizations. But what are capability maps and are they useful?

The 'space' in which a capability map lies could be thought of as a level of abstraction above the traditional company organization chart. It is a diagram that sets out the organization's *capabilities*, a term for the collective abilities that can be applied to achieve specific outcomes. Simplified examples of media company capabilities are “create content” or “deliver content to users”.

The map is a view of an organization but it is not the organizational structure, as Figure 1 illustrates. The capabilities can be seen as the organization's skills (as opposed to the skills of an individual).

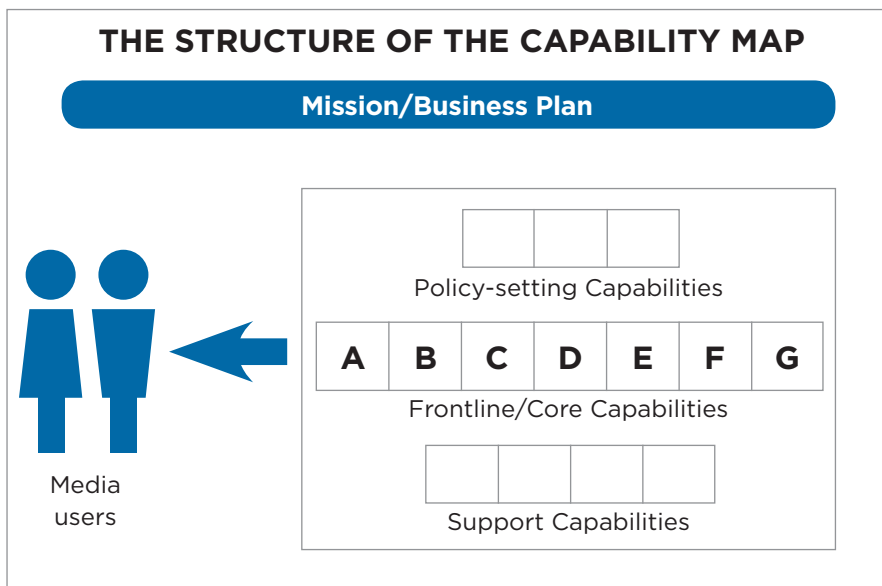
The capability map can be used as a bridge between creating a strategy and knowing what needs to be done to achieve it. Once completed, the capability map can be used for many purposes, including areas such as prioritizing activities. It is a view of the organization that is independent of specific projects, processes or technologies. It is thus distinct from an organizational structure, but I am sure you get this.

Capability maps can be applied to any organizational unit from a given department to the whole company, but they are usually applied to, and are most useful for, the whole organization. In a sense the capability map tells us the potential of the organization.

You may be wondering what kinds of questions capability maps have helped to answer in industry at large? And are any of them important for media organizations?

The idea, when you've completed your capability map, is that you can see more clearly such things as the capabilities that have the greatest impact for your customers, where there are gaps, or which ones might need to be strengthened for new services. It can help to identify where resources should be focused and where technology could be best used to lower costs or enhance resources. It can also show where outsourcing of capabilities might make sense.

Capability maps can be a useful tool for EBU Members. It should be said that not all managers find the concept understandable, and some argue that it is more academic than practical. Equally, many organizations have found it useful to create and use them, so it is certainly worth looking into. It takes time and energy to create a capability map, but that can be offset against multiple types of analysis it makes possible. Be sure to look out the EBU Capability Map when it has been published!





Laying the groundwork for audio and video transport

The Video Services Forum (VSF) has a long history based on supporting the transport of broadcast video and audio over long distances. But it might be that you have never heard of it, writes **Brad Gilmer**, Executive Director.

The VSF, building on the work of the Pro-MPEG Forum, created the SMPTE 2022 family of transport standards. More recently, it worked for almost two years to write VSF TR-03 and VSF TR-04, which became SMPTE ST 2110. Now it has released the RIST specifications for broadcast video transport over the generic internet, and work is continuing on expanding ST 2110 for use in WAN environments.

EISENHOWER'S SPEECHES

It may be helpful to understand the history behind the VSF in order to understand its focus on transport technology. In the 1950s in the United States, there was only one telephone company, American Telephone & Telegraph (AT&T). During this time, AT&T was asked to build a special broadcast terrestrial network, linking the New York-based broadcast centres of the "Big Three" broadcast networks of the time, ABC, CBS and NBC, with local stations across the nation. Essentially, the government asked AT&T to build a separate, technologically completely different overlay network on top of their wired telephone service. Speaking frankly, the driver behind this initiative was President Eisenhower's desire to be able to speak live on national television directly to the citizens of the country in times of crisis.

This new network was completely separate because it relied on technology that was new and different from wired telephone circuits. An informal group of video transmission subject matter experts from AT&T along with the Bell Regional Telephone Companies worked together to build this



Brad Gilmer, Executive Director, Video Services Forum

separate and special broadcast terrestrial network. These video transport subject-matter experts helped each other with technical issues, including the informal loan of specialized video transport equipment when necessary. In 1997, after numerous twists and turns, this group was formally organized as the Video Services Forum. The VSF currently has 80+ members made up of users, manufacturers and service providers.

TREND-SPOTTING

In addition to foundational work on a number of industry initiatives discussed above, the VSF holds a yearly conference called VidTrans,

with a programme that has focused on professional video transport. Several industry trends have been discussed at this conference including video transport over SONET networks, the rise and fall of ATM (asynchronous transfer mode), and critically, the prediction early on that the dominant transport stack for video would become IP over Ethernet over SONET.

JT-NM

The VSF has actively sought to partner with other organizations in the industry. One important partnership is with the EBU, where both organizations serve on the administrative group of the Joint Task Force on Networked Media (JT-NM). The VSF, with the support of FOX and Riedel Communications, has provided space at The Woodlands, Texas and Wuppertal, Germany for a series of JT-NM Tested events. The EBU, with the support of other organizations, has developed the premier testing programme for SMPTE ST 2110, AMWA NMOS, PTP and JT-NM TR-1001 equipment. (See page 14.) The VSF continues to sponsor the IP Showcase Theatre at IBC and NAB with the help of Wes Simpson (Telecom Product Consulting), who has curated this very successful event. (Note that the IP Showcase will be continuing over the summer as a virtual event.)

Membership in the VSF is open to users, manufacturers and the providers of video transport services. We continue to evolve as an organization and look forward to continuing our long relationship with the EBU.

More information: vsf.tv

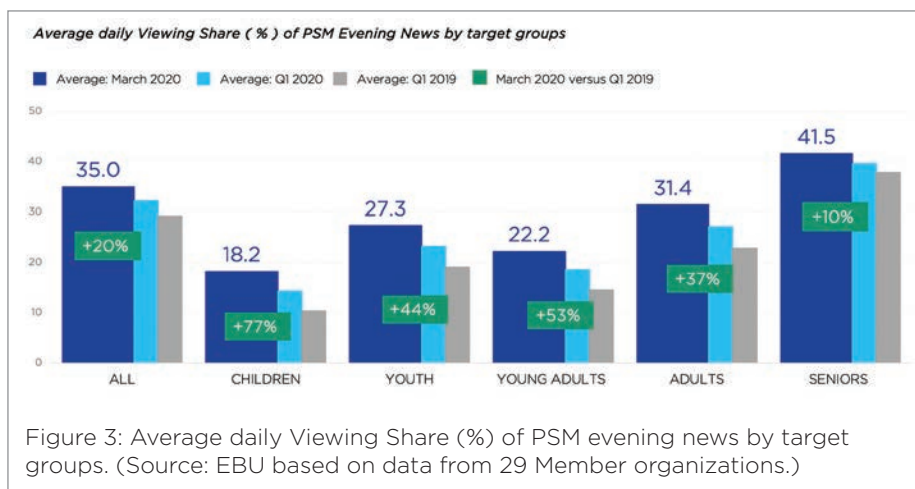
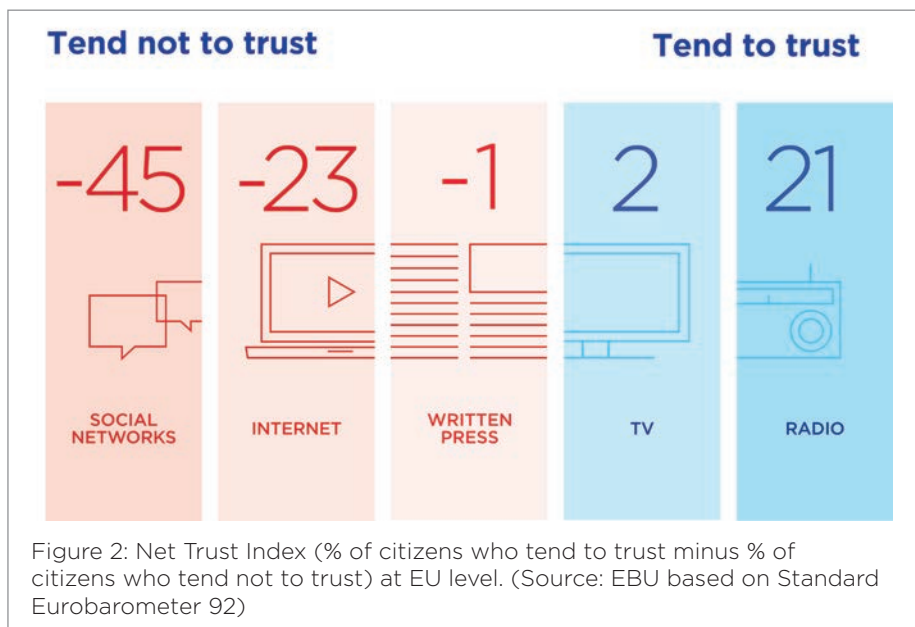
PSM and trust: well positioned for times of crisis

As a tide of misinformation rises, investing in trust is a key performance marker for quality media organizations. **Dominik Speck**, Visiting Researcher at the EBU Media Intelligence Service, takes a look at recent data on how credible the audience perceives different media to be.

Generating an unprecedented degree of uncertainty, the COVID-19 crisis highlights the importance of trust. But how well do the media perform in credibly updating the public when even experts are strikingly unsure about which information to rely on?

Public service media (PSM) are in pole position here: they already enjoyed rather high levels of trust prior to the outbreak. PSM have the most trusted news brands in 16 of 26 markets surveyed in 2019 for the Reuters Institute’s Digital News Report (Figure 1). Furthermore, Eurobarometer data shows a clear trust gap between traditional media – radio, television and, to a lesser degree, the written press – and “new” digital media (Figure 2). At EU level, trust in the internet and social networks has seen significant declines during the past five years, compared to almost stable trust in traditional media. In short, higher trust is placed in media where PSM play a central role.

It thus comes as no surprise that citizens rely on PSM for trustworthy information during



the current crisis. Even so, the boost in usage of PSM news is remarkable: across 29 EBU Members surveyed by the EBU’s Media Intelligence Service, daily viewing of evening news had increased by 20% on average in March 2020 compared to the first quarter of 2019 (Figure 3). For young citizens (aged 15–24), the increase was 44%.

While research shows that generally the use of a medium does not necessarily imply trust in its news coverage, citizens consider PSM information on COVID-19 as credible. In Germany,

86% of PSM television news users rate the coverage of ARD and ZDF as trustworthy – the highest attributed credibility of all media within the country. And 90% of Czech Television news viewers consider the crisis coverage of their public broadcaster as trustworthy – to just give a couple of examples from EBU Members.

Access detailed reports and other material on both trust in media and how PSM have been performing during the COVID-19 crisis at: www.ebu.ch/mis-publications

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



A PINCH OF BROADCAST IN THE OTT SOUP

EMILY DUBS (DVB PROJECT)

How DVB-I helps to bring the simplicity of broadcast to OTT



DATA-DRIVEN VIDEO WORKFLOWS

DANIEL WEINBERGER (BITMOVIN)

Using data to target the key user experience metrics



MINIMIZING COVID-19'S IMPACT ON RADIO PRODUCTION

GIOVANNI RIDOLFI (RAI)

Part of the EBU COVID-19 Radio Production Roundtable



HOW TO SUCCESSFULLY STREAM YOUR LARGE-SCALE EVENT

FRANCK CHEVALLIER (LIMELIGHT NETWORKS)

Using multi-CDN to address the challenge of large-scale events



ADVANTAGES OF MULTI-SOURCED CACHING SOLUTIONS

MARTIN SCHMALOHR (IRT), JULIAN HORSTSCHÄÄFER (WDR)

Player-based hybrid-CDN service including a cache server



BBC ARCHIVES DURING COVID-19

STEVE DALY (BBC)

Part of the EBU COVID-19 Open Archives Roundtable

IN THE SPOTLIGHT

Jordi J. Giménez

5G-MAG PROJECT MANAGER

WHAT ARE YOUR CURRENT RESPONSIBILITIES?

I became the 5G-MAG Project Manager in April this year. We aim to facilitate collaboration within the media industry on the analysis, implementation and deployment of 5G solutions to create benefits across the entire value chain, from content creation to end-user consumption.

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

I cannot highlight one specific achievement but I am certainly proud to have contributed to collaborative work in, for example, EBU groups, DVB study missions or, more recently, 5G standardization. You can always feel like you are part of something significant.

WHAT ARE YOUR PREDICTIONS FOR MEDIA TECHNOLOGY IN THE FUTURE?

The media industry is immersed in IP-driven technological evolution. There is a need to automate processes, to enable remote operations, and also to adapt to new user behaviours, especially with young audiences. I am sure more changes will come with the availability of new technologies.

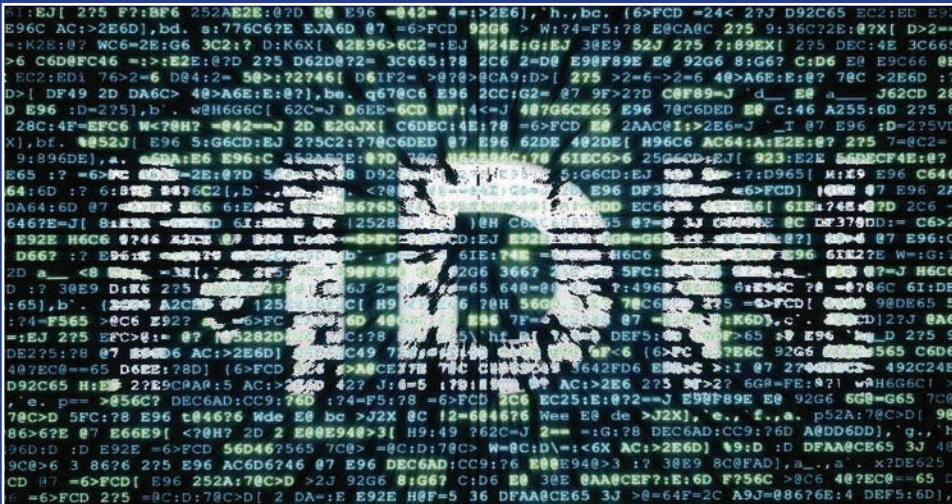
WHAT, FOR YOU, ARE THE BIGGEST CHALLENGES FOR EBU MEMBERS TODAY?

I see two main challenges in terms of distribution: to retain the prominence of PSM among audiences that might be confronted with an increasing number of platforms and services; and then to guarantee economic sustainability and universal access for reaching audiences across such platforms.

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

Beyond technology, which also occupies part of my free time, I enjoy walking or cycling around cities, discovering their natural and cultural spots. A bit of sport to stay healthy is also part of my daily life.





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