

tech-i

UHD-HDR- HFR-NGA: Can we do it live yet?

Plus

- **ASSESSING 5G FOR BROADCAST**
- **VOICE CONTROL FOR RADIO**
- **FULL STANDARDS STACK FOR IP PRODUCTION**

and more...

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On the cover: Pete Andrews (BBC) was the Director for the EBU-coordinated live production of UHD-HDR-HFR-NGA at the European Athletics Championships 2018. Find the full story on pages 10-11.

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Design: Louise Tait
 Printed on FSC certified paper by
 New Goff n.v.

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Building success based on synergy

Antonio Arcidiacono
 Director of Technology & Innovation, EBU



My priority since I stepped into this role, just a couple of months ago, has been to listen and to understand. Conversations with EBU colleagues, the Technical Committee and – most importantly – our Members around Europe have been helping me to crystalize our path forward.

The primary role of the EBU Technology & Innovation Department, as I see it, is to help Members conceive, develop and launch new products and services. Collaboration is the key to achieving this. By pooling resources and tapping into R&D-related funding opportunities at a European level, we can find and build on synergies that will help Members to confront the challenges they face daily and maintain a position of excellence in their respective markets.

With any innovative product, 50% of the effort goes into the conception and development, but the other 50% is definitely in the lessons learned and the related solutions that emerge from the actual launch with the first real customers. I'm committed to leading an active and interactive dialogue with our Members to identify the initiatives that show the most promise and find the synergies to make them a reality.

The EBU benefits from the fact that our Members do not directly compete with each other. We are ideally positioned to help those that are ahead of the innovation curve to be more efficient and to share the burden of pioneering; but we must also support those who are lagging behind, based on the lessons learned by the early adopters.

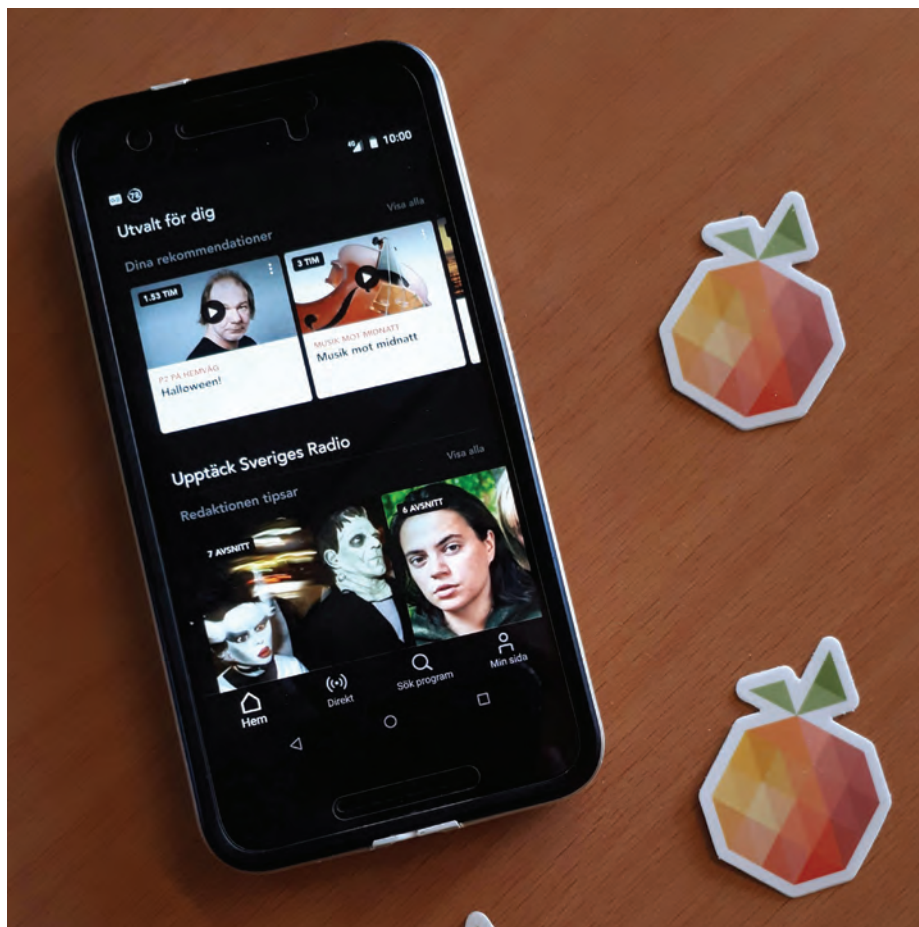
REAL PRODUCTS

There are many technology pillars around which new initiatives can be built: AI, virtualization and cloud-based technologies, the use of shared resources, blockchain, and so on. But it is the actual deployment of new products and services with anchor Members that will ensure our innovations are materialized into real “products”. There are already good examples of this approach in action. The EBU PEACH and Flow projects, providing respectively solutions for personalization and multi-CDN delivery, have shown what we can achieve through co-development, with small groups of Members taking the lead.

Finally, a specific mention of radio-frequency spectrum. This is the precious “land” upon which EBU Members have been developing and operating services since the inception of public broadcasting. Regardless of technological advances, the spectrum used remains a unique asset that must be protected. This means we must fully exploit this resource to the large-scale benefit of audiences, using the unique physical advantages of native broadcasting technologies. We need to be proactive, finding new ways to prove that other forms or uses of broadcasting can bring huge benefits to society and citizens.

I'm delighted to take on this role, building on the good work of my predecessor Simon Fell. Don't hesitate to get in touch (arcidiacono@ebu.ch) and share your thoughts on how we can find success working together.

Sveriges Radio joins the PEACH team



PEACH, the personalization and recommendation ecosystem built by broadcasters for broadcasters, has welcomed Sveriges Radio (Sweden) to the team. This EBU project is an active co-development between RTS (Switzerland), BR (Germany) and now also SR.

With the aim of offering a fresh, personalized radio experience to its users, SR has been looking into multiple solutions. With the help of the PEACH team, a live test was conducted this summer in the mobile application, with the aim of providing the most relevant content for each individual user within their mobile app.

The development team also undertook a couple of lab days to trial the PEACH data science platform and gain a good understanding of the recommendation algorithms used. They concluded that PEACH enables them to create

the content proposition they want for their users, and that the users were indeed listening to the content recommended.

The PEACH solution comprises single sign-on, playlists and a history API, a full data pipeline, and a data science platform to explore and process data, leveraging big data technologies for content recommendation and understanding users. This ecosystem helps broadcasters in their digital transformation: creating digital products with the cross-device user-centric experience their users have come to expect through using platforms such as Netflix or Spotify.

PEACH services will be deployed progressively in SR's app in the coming months. Multiple algorithms will be used to recommend content that is both relevant and more diverse to the users.

See: peach.ebu.io

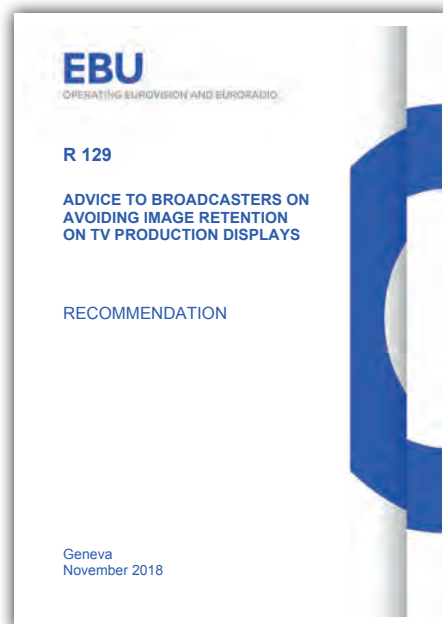
The burn is back

About a decade ago, around the time HDTV was starting, the topic of screen burn-in was a hot issue, especially for people buying plasma displays, writes Frans de Jong. Fast forward ten years and the burn is back! Now OLED displays have taken the top spot for burn-in susceptibility, although LCDs are not immune. To help minimize the risk of screen burn-in, the EBU has updated Recommendation R 129.

Burn-in can be defined as static image retention or premature display ageing due to parts of the image not changing for long periods of time. Static content is not uncommon – channel logos, sports scores and news tickers are good examples. To reduce the risk of damaging production monitors and by extension, consumers' displays, the EBU recommends that the time static content is displayed is reduced or the signal level lowered.

For standard dynamic range (SDR) the EBU recommends a limit of 40% of peak white, while for HDR (HLG) the level is set at 47% of *reference white* (35% of peak white). This applies equally to highly saturated colours that can also cause burn-in.

See: tech.ebu.ch/publications/r129



Arcidiacono to deliver keynote in Dublin

The opening keynote at DVB World 2019 (11-13 March) will be delivered by EBU Director of Technology & Innovation Antonio Arcidiacono. As a former member of DVB's Steering Board, for his previous employer Eutelsat, he has followed the evolution of the organization over many years.

He will talk about the continued need for broadcasters and regulators to engage in the work of DVB, where success has been built on the active involvement of all stakeholders. While the analogue to digital shift has largely been completed for broadcast networks in Europe, important specification work remains to be done to ensure that EBU Members can embrace OTT while maintaining the secure and robust delivery

associated with DVB services.

DVB World 2019 is taking place at Croke Park in Dublin. The event was held in the Irish capital from 2001 to 2007, but since then it has visited a new city every year. It is thus, in a way, returning to its roots in 2019. An exciting programme will include sessions on 5G for broadcast, OTT and hybrid delivery (including an

update on progress with DVB-I), the future evolution of end-user devices for media and the making of technical standards in the modern world. The pre-conference masterclass will focus on implementing HbbTV.

Early bird registration is available until the end of January.

See: www.dvbworld.org



Don't miss the media revolution!

The EBU Production Technology Seminar returns at the end of January with another packed programme, *writes Hans Hoffmann*. We've picked as our theme for the event "Revolutionize Media", which really captures the exciting transformational phase we're going through right now in media production.

Reading through the programme, we see words and phrases that bring to mind the challenges facing public service media: "blockchain", "spot the fakes", "speech-to-speech translation", "cloud computing for remote production", "5G in production workflows", "object-based audio", "AI in content production"... The list goes on!

As usual we have a diverse mix of top presenters from around the world. Michael Zink, VP of technology at Warner Bros. will feature in the opening keynote session, alongside the chair of our EBU Technical Committee, BBC's Judy Parnall. The ever-popular tutorials will cover the IP production full stack, producing HDR, transforming production for the next generation, and how to deploy AI and metadata in workflows.

The EBU building in Geneva is always buzzing during PTS, with Members, vendors and the research community rubbing shoulders and sharing inspiration. The event is typically full to capacity, so early registration is strongly encouraged. **See: tech.ebu.ch/pts2019**

How can radio reach new heights?

February 2019 brings the EBU Digital Radio Summit, *writes Ben Poor*, gathering technologists and strategists from across the radio industry, as well as vendors and implementors. The Summit is the highlight of a series of events in Digital Radio Week, covering broadcast, broadband and hybrid radio.

Sessions at this year's Summit will include a look at how some of the hottest current topics are likely to evolve in future. This will include both smart speakers and connected cars: what should radio do now to ensure its future prominence, and what will this mean for audiences?

Content remains king, whether newly created or drawn from existing archives. Both public and private broadcasters possess rich repositories of content that can potentially be made more accessible on newer platforms. With a second wave of hype for podcasting transforming into gradual growth, the issues of discovery and accessibility become important – if podcasting is to become a truly open platform, can creators be more directly linked to potential consumers?

As well as the Digital Radio Summit, the week includes the free RadioHack event, bringing together coders, thinkers and tinkerers to help create new radio experiences. We also welcome back a number of other industry events, including those from both RadioDNS and WorldDAB.

See: tech.ebu.ch/drs2019

Practical guidance to combat cybercrime

October's EBU Media Cybersecurity Seminar, the second annual edition of this event, was considered so useful, *writes Adi Kouadio*, that some participants suggested it should be repeated more frequently! While the plan remains to hold the event annually, EBU Members can access videos and slides from all presentations, providing a wealth of practical information on a range of cybersecurity topics.

The keynote presentation from Matthias Bossardt, KPMG's head of cybersecurity services in Switzerland, emphasized the scale of the problem. Just as software and platforms are now available as an online service, "Crime as a Service" has become a reality. With just a few clicks, it is possible to order a DDoS (distributed denial of service) attack.

This democratization of online crime demonstrates the importance of keeping track of emerging threats and taking the necessary action to mitigate them. He recommended that public service media organizations should keep in close contact with their respective national cybersecurity office.

The seminar programme

covered topics such as cybersecurity for field operations, content protection, GDPR and the impact of disruptive technologies. During the tutorials, videos of which are also available, attendees received practical advice on the steps required to undertake due diligence on cloud providers and valuable guidance, from VRT's cybersecurity expert Gerben Dierick, on the EBU Recommendation on security tests for networked equipment (R 148).

One of the overriding takeaways from the seminar was that cybersecurity is not a one-time task, but an ongoing journey. This applies equally to GDPR compliance as to vulnerability assessment, especially in today's context of continuous deployment of software applications.

Eoin Keary of Edgescan stressed the need for vulnerability assessment to be built into workflows. He said that media companies needed to undertake full stack vulnerability assessment, looking not only at the web layer, but also at the application and infrastructure layers, and on a continuous basis.

See: tech.ebu.ch/mcs2018

New co-chairs for EBU cybersecurity group

The CISO (Chief Information Security Officer) of Switzerland's SRG, Andreas Schneider, has stepped down after four years leading the EBU strategic programme on Media Cybersecurity. The group will now be co-chaired by John Moylan, CISO of Ireland's RTÉ, and Claus Bayer, CISO at Germany's ZDF. Its aim is to help Members to build and exchange knowledge of cybersecurity threats to their organizations.

John Moylan, speaking about his new role, said: "It is an honour to chair such a group of talented experts. The road to bring the media industry up to speed on cybersecurity is not easy, especially with the growing threats towards digital services and public service media in general. But we have established a strong strategy that will help achieve our goal." His fellow co-chair Claus Bayer said: "One of the key challenges for broadcasters is to have proper governance for cybersecurity within their organization, and for systems vendors to perform the minimum security due diligence on their hardware and software. As a group we are committed to help both communities in this process."

See: tech.ebu.ch/groups/mcs



The keynote speaker was Matthias Bossardt, KPMG's head of cybersecurity services in Switzerland.

DTT: in decline or on the up?

NEWS OF DTT BEING SWITCHED OFF IN SOME COUNTRIES HAS PROMPTED SUGGESTIONS THAT IT MAY DISAPPEAR ALTOGETHER. THE EBU'S **MARCELLO LOMBARDO** LOOKS BEYOND THE HEADLINES AND FINDS A VERY DIFFERENT STORY.

Last May Belgian public broadcaster VRT announced that its free-to-air DVB-T transmissions would end on 1 December 2018*, citing “changing media consumption usage”. Just a few months later, in the aftermath of the “No Billag” referendum (which proposed to eliminate the mandatory licence fee to fund broadcasting), Swiss public broadcaster SRG SSR announced the end of DVB-T transmission in 2019.

JUMPING TO CONCLUSIONS

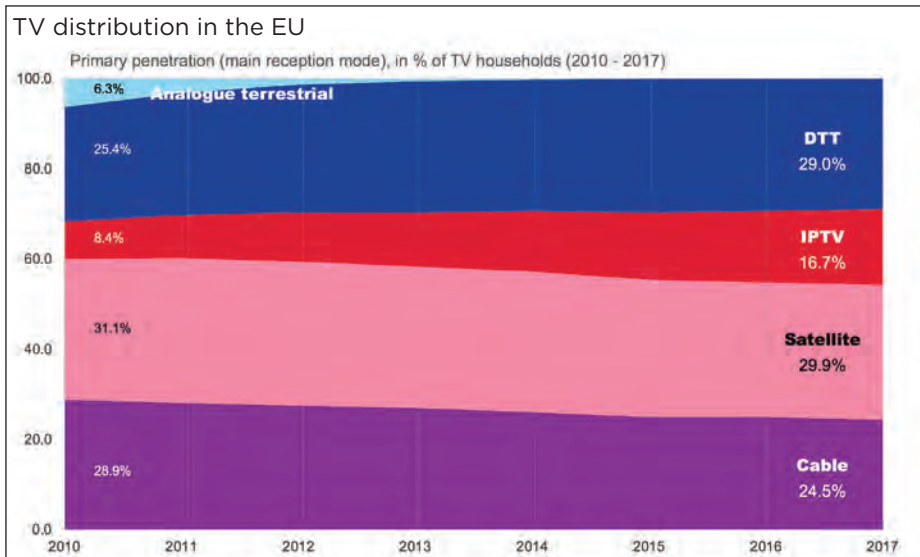
Taking these decisions in Switzerland and Flanders together, one might conclude that the sun is setting on digital terrestrial television (DTT). However, before rushing to conclusions, we should carefully analyse the specific contexts and the overall trends.

The EBU Media Intelligence Service regularly produces an excellent report on *TV Distribution in Europe*. It provides data on, among other things, the penetration of the various television distribution platforms.

Analysing the data, we see that, in terms of television distribution, Belgium and Switzerland are very similar. In both countries the primary distribution technology has historically been cable, now being gradually replaced by IPTV; and in both countries the combination of cable and IPTV serves more than 90% of households as the main reception mode, followed by satellite and DTT. The latter has never exceeded 5% penetration as the main reception mode in either Belgium or Switzerland, amounting to a very small number of households in absolute terms. .

No other country in Europe has a television distribution landscape that mirrors these extreme figures.

The similarities between Belgium and Switzerland



continue when it comes to infrastructure capabilities, particularly the coverage of cable and fixed broadband. The European Commission document *Broadband Coverage in Europe 2017* provides the data.

For cable, both Belgium and Switzerland appear in the top four. In fact, in Belgium coverage exceeds 95%, while in Switzerland it exceeds 80%, both countries far above the EU-28 average of 45.1%.

For fixed broadband, the NGA (next generation access) combination category, which comprises VDSL, FTTP and DOCSIS 3.0 technologies (all typically capable of delivering a service speed of at least 30 Mbps), sees Belgium and Switzerland in the top three. Both show coverage levels above 95% against the EU-28 average of 80.1%.

200,000 VS. 60 MILLION

With this clarity about the context in these two countries, it becomes easier to understand why the decisions regarding DTT have been taken. In Belgium and Switzerland DTT has never historically been successful; switching the service off impacts only a very limited number of households (about 200,000 in

total). Most, if not all, impacted households are covered by alternative distribution platforms (like cable, IPTV or satellite), which ensures continuity of service and the fulfilment of public service obligations. For the vast majority of European countries, switching off DTT is simply not an option owing to the absence of a sufficient offer of alternative platforms.

While in Belgium (or at least Flanders) and Switzerland, public broadcasters have elected to switch off DTT, we see that in the rest of Europe the platform is strong and stable. As of 2018, 29% of households in the EU-28 rely primarily on DTT. That's almost 60 million households versus the 200,000 affected by the decisions in Belgium and Switzerland.

The impressive adoption rates for DTT, for which total penetration exceeds – and often far exceeds – 50% in more than 20 European countries, have led many of the earlier adopters to actively plan an upgrade of their transmission technology from DVB-T to DVB-T2. This is another strong indicator of the good health of the platform. Numbers don't lie. DTT is here to stay.

*The VRT channels remain available on the Antenne TV DVB-T2 pay-TV platform.

Transforming coverage of live events with AI

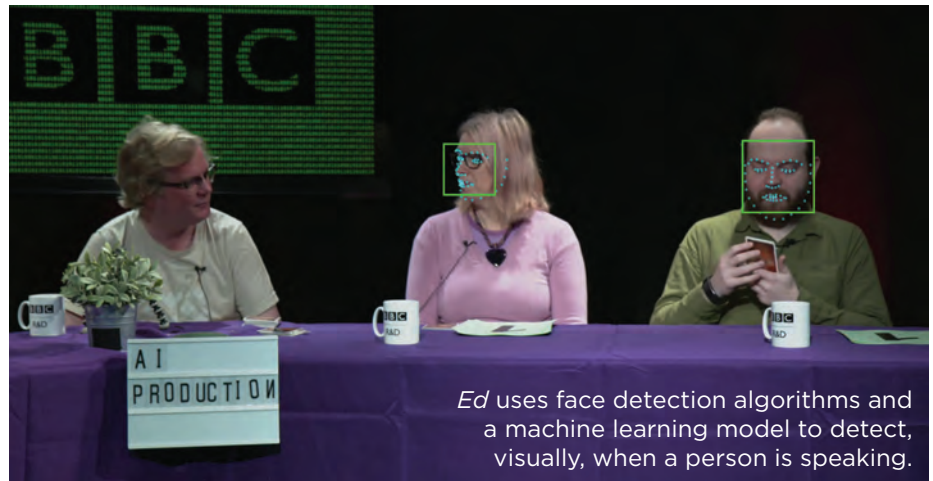
WINNERS OF THE BEST PAPER AWARD AT THE IBC2018 CONFERENCE, **STEPHEN JOLLY** AND **MICHAEL EVANS**, RESEARCH LEADS AT BBC R&D, OUTLINE HOW NEW TECHNOLOGY MIGHT ENABLE BROADCASTERS TO COVER MANY MORE LIVE EVENTS.

One of the too-often forgotten wonders of broadcasting is the way in which the industry brings live events – from stages and fields and stadiums – to our viewers. Outside Broadcasts are impressive technical achievements, but all broadcasters are fundamentally constrained in the number of venues they can cover. What if we could produce a hundred times more coverage than we do now? More festival stages? More specialist sports? More community events?

AI IN PRODUCTION

In our *AI in Production* project, BBC R&D is continuing research that aims to dramatically increase the range of live cultural events that broadcasters can cover, by supplementing the relatively small set of prestige OBs with many, many more venues at reasonable quality and very low cost. Our prototype system attempts to automate the process of creating edited, *as-live* coverage of a performance. A rig of several unmanned, locked-off UHD cameras is installed in a venue beyond the scope of a traditional OB, and artificial intelligence (AI) techniques are used to crop appealingly-framed shots. The system also cuts between them to produce edited output.

Live production teams are expert in looking at an event that's taking place – be it a musical or theatrical performance, a panel show or a monologue – and working out what a television viewer will most want to see moment to moment. Crews use their skill to choose and switch subjects and shots to please the viewers' eyes and maintain their interest.



Ed uses face detection algorithms and a machine learning model to detect, visually, when a person is speaking.

Replicating such judgements in an AI system, even in a limited way, is our fundamental challenge.

PRACTICAL IMPACT

Our experimental prototype (codenamed *Ed* after 1950s filmmaker Ed Wood) is a rules-based system built on machine learning and conventional computer vision. Currently, *Ed's* rules are specific to discussion or comedy among a panel of performers, looking for human faces in the footage and tracking the current speaker. We use off-the-shelf face detection algorithms, combined with a machine learning model that detects, visually, when a person is speaking.

Simple models of attractive framing embody the *rule of thirds* and *looking room* concepts. The system attempts to change shots to a regular rhythm, but shifts the shot boundaries forward or back in time to try and avoid cutting to people just after they start speaking, or away from them just before they stop. It also tries to show a variety of shot types in familiar sequence, preferring closer shots if someone is speaking, often intercut with

contrasting reaction shots.

To evaluate and improve the quality of our AI-produced video, we think it's important to use empirical studies, asking real viewers to compare what *Ed* makes with equivalent content produced by skilled professionals. It's possible that video made by algorithms will never approach what a well-trained human can do, but will be good enough for many situations where a conventional OB isn't possible. More details of our prototype and first major study can be found in the paper *AI in Production: Video Analysis and Machine Learning for Expanded Live Events Coverage*, for which we were honoured to receive the IBC2018 Best Paper award.

FUTURE VISION

We're learning a lot from this work, and although it's clear that AI will have a big impact on media production, major disruption is unlikely in the short term. Automation technologies have long influenced broadcasting and, like those before it, AI will be most effective when it is applied to the most repetitive and time-consuming aspects of craft roles, giving people more time to be creative.

2110 is just the tip of the pyramid

FORMERLY OF THE EBU, **FÉLIX POULIN** IS NOW DIRECTOR OF ENGINEERING LAB SERVICES AT CBC/RADIO-CANADA. HERE HE EXPLAINS WHY A MINIMUM STACK FOR MEDIA ENDPOINTS IS NECESSARY FOR FULL SCALE IP-BASED FACILITIES.

When we received the first pieces of IP-based equipment in our lab, we realized how labour-intensive and tedious it was even just to start using them compared to the good old SDI technology. It became clear that while the SMPTE ST 2110 transport standard was necessary, it alone was not sufficient to build and moreover maintain a large-scale facility.

SIMPLIFIED BUT COMPLEX

Moving from SDI to IP simplifies the cabling and physical infrastructure by allowing devices to be interconnected with the network switches using standard networking cables rather than individual specialized cables for each kind of signal.

However, the configuration of devices with IP addresses and media flow connections gets hidden in the underlying logic, which increases the complexity of the operations. This requires more planning and initial configuration work than today, but also the careful management of any system change to avoid outages that otherwise can take a long time to troubleshoot.

When our engineering team started to design our new all-IP facility – to be on air at the beginning of 2020 – we had to specify several additional technologies that vendors must provide in addition to 2110 so that the IP-based gear would be practical for our project.

Talking to other broadcasters with similar projects, like the SRF/TPC building in Zurich or BBC's Cardiff Central Square project, it became clear that all endeavours of this kind will face the same challenge: 2110 transport needs to come with these other technologies that make it manageable at large scale. Thomas Edwards from Fox, as the keynote speaker at the EBU Network Technology Seminar last June, could not have expressed it better: “We need full stack solutions.”

The EBU strategic programme on Production Infrastructures recognized this need and established a working group. The first outcome is a synthesis of our group discussion. We prepared the pyramid graphic below for IBC2018, to carry the message to the industry.

PYRAMID LAYERS

As you might expect, the pyramid has as its tip SMPTE ST 2110 transport, mandating profiles that are otherwise optional in the standard. But this is just the tip.

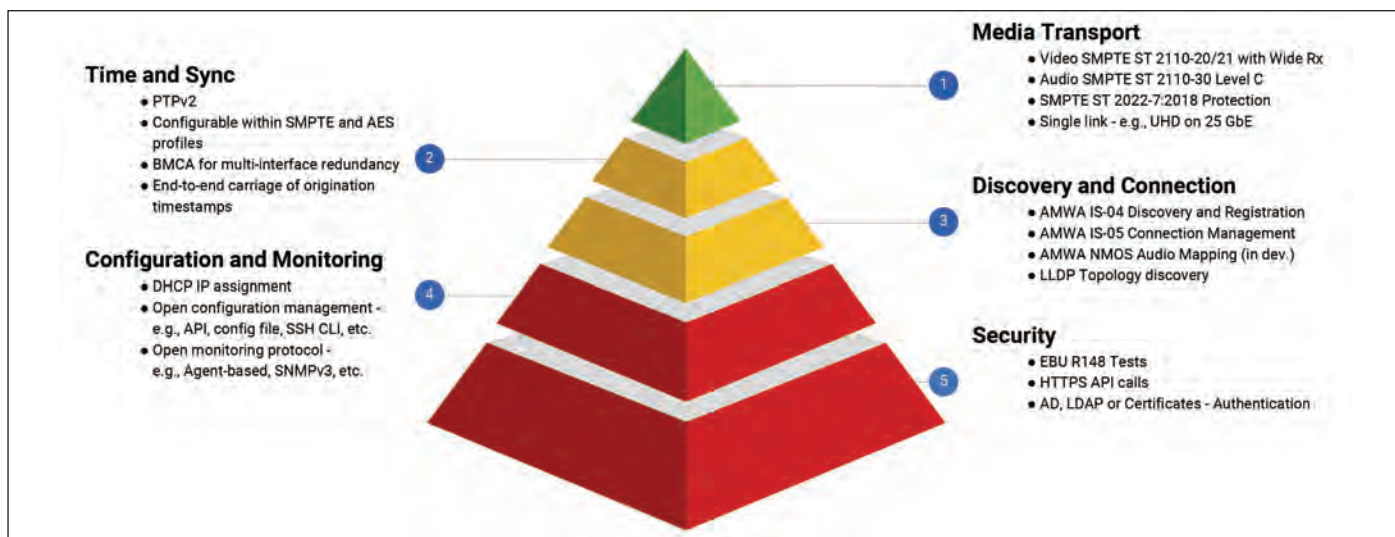
On Time and Sync some standards work is still to be done on how endpoints deal with receiving PTP signals on multiple interfaces, as in a SMPTE ST 2022-7 redundancy scenario.

Technologies for Discovery and Connection Management are available with AMWA IS-04 and IS-05. However, they still lack wide market adoption and must be made available as a minimum common denominator across all devices. Configuration and Monitoring is well understood in the IT world, but it is the next step our industry needs to understand and tackle. Open alarming and telemetry plus remote configuration will provide “manageability” for our large facilities.

Finally at the base of the pyramid, because it is fundamental in today's cyberspace climate, is the need for secure endpoints.

The good news is that the Joint Task Force on Networked Media – bringing together the EBU, AMWA, SMPTE and VSF – is working on a technical recommendation that will address a number of these user requirements. Stay tuned for more announcements on this.

See: tech.ebu.ch/fullstack





The Master Control "Lounge" at Radio Television of Kosovo.

Our journey to IP

EBU MEMBER RADIO TELEVISION OF KOSOVO HAS ENTHUSIASTICALLY EMBRACED THE USE OF IT AND IP-BASED EQUIPMENT IN PRODUCTION AND DISTRIBUTION. **GENC MUCOLLI**, SYSTEM ADMINISTRATOR, TELLS THE STORY.

As an IT department our journey to the broadcasting world began back in 2004, when we purchased a playout server for our master control room (MCR). This showed us the operational flexibility that IT-based equipment can offer to broadcasting. Since then we embarked on a path of creating "homebrewed" systems including a programme scheduler and a newsroom module. In 2014 we created our own file-based production system that covers all levels of production and internal distribution. We also equipped all our studios with playout servers, capture machines and generally as much IT-based equipment as possible.

Within the IT department we often discussed the next steps in the evolution of our television facilities. Going to IP was always a potential leap forward, but the existing technology options were limited for a long time. Advances in networks and switching have now made this step possible.

SDI MUST DIE!

Our journey has been anything but easy. In the broadcasting world, IP was for a long time seen as Darth Vader: evilness embodied in technology that broadcast engineers must fight

forever! We didn't buy into that perception, however, and were happy to risk some criticism for daring to use non-standard technology and solutions in our workflow. We liked the catchphrase of one of our vendors, Cinegy: "SDI must die!"

We understand the importance of standardizing the technology and working methods. On the other hand, standards around radio, for example, were not enforced prior to the invention of radio but years afterwards. Arguably the same goes for developments happening now in media production technology.

While many broadcast engineers see IP as a rival of SDI, we see it another way: we don't think IP is a competitor to SDI. Rather IP is simply SDI's successor in taking broadcasters to the next level. Our belief is that SDI doesn't retain any real technical or commercial benefit.

We understand that moving from SDI to IP will take a toll, as so many of the skills developed over the years by broadcast engineers become obsolete. But we need to evolve in order to carry out our public service mission and to align with audience demands for information and speed of distribution on the huge variety of platforms we need to address.

IP offers us so much flexibility and endless possibilities; it is future proof and will come at a lower cost than SDI-based equipment.

UP AND RUNNING

We have started broadcasting from our IP-based MCR. (In fact, we re-named it the Master Control Lounge, as along with the technology we also changed the environment to escape that classic greyish look common to almost every MCR!) Broadcasting five channels since 20 July 2018, we haven't had any major problems. It is much easier, as an operator uses only one machine (PC) to control a channel.

We started broadcasting in HD as of September 2018. It was just a matter of configuration - no equipment in the MCR needed to be changed. Now the plan is to interconnect the MCR with our file-based production system, allowing many workflow processes to be automated and changed for the better.

This is a very exciting time for IT and broadcasting professionals and enthusiasts, as there is so much development going on. At RTK we are very excited about the challenges that await us - we will face them with dedication and enthusiasm!

Testing UHD-HDR-HFR-NGA live

THE EBU TESTED THE LATEST PRODUCTION TECHNOLOGY DURING THE EUROPEAN ATHLETICS CHAMPIONSHIPS (EAC 2018), WRITES **FRANS DE JONG**. THE EXERCISE PROVIDED VALUABLE INSIGHT INTO THE STEPS 'BEYOND HD' - AND GREAT TEST MATERIAL TOO!

There are five ways to improve current HDTV: add more pixels (UHD), more luminance levels (HDR), more colour (WCG), more frames per second (HFR) or better audio (NGA). To test what this means in practice, the EBU organized a live trial production during the first edition of the European Championships. The goal was to test 'Beyond HD' technology under real-world conditions.

Outside the Olympic Stadium in Berlin five containers were transformed into an audio control room, a video control room and a technical area with seven racks of the latest production equipment. About 40 representatives from five Members and 20 industry partners worked together to create content in 2160p/100 HDR HLG, 1080p/100 HDR HLG and 1080p/50 SDR. Audio in AC-4 (Dolby Atmos) and several flavours of MPEG-H audio were produced.

The signals were sent over fibre to the Broadcast Operations Centre in Glasgow and via satellite to the Rai 5G test bed in Italy (see page 13). The material was also recorded locally, both uncompressed and in XAVC Class 480 (~1,600 Mbps!).

HFR NOT (YET) PRACTICAL

Athletics was chosen as it provides fast-moving action, making it ideal for testing HFR. To achieve capturing at 100 Hz, four Sony HDC-4300 cameras were positioned in the stadium and connected via SMPTE 311M cable. In the technical area the video was obtained as two separate 2160p/50 signals, each representing either the 'odd' or the 'even' frames of the full 100 Hz signal. Using 3G-SDI interfaces, this meant eight cables were needed per source.

The trial proved it is possible to achieve high-quality images this way, but it also showed it is



not (yet) practical. Besides the SDI interfacing, there is no phase-signalling, nor p/100 timecode and it is currently not possible to properly monitor the p/100 signals, as there are no p/100 reference monitors yet. The only 100 Hz capable displays available are consumer devices, and even those are very rare. In Berlin two 55" LG televisions with prototype software were used to receive the signals using a DVB input. The production monitoring was done using one phase only, on Sony BVM X-300 reference monitors.

HDR: EASIER FOR THE SHADER

The event in Berlin was ideal for testing HDR. The combination of bright sunlight and deep shadows, daytime and night-time events, and the use of artificial lighting in the stadium provided a wide variety of challenging conditions. The clear overall impression is that HDR can add quality to the picture. Especially where bright sunlight or artificial light is in the game. The shader quickly learned how to use the wider luminance range. He was impressed by the natural look of the images and the fact that fewer corrections were needed.

One important aspect for broadcasters is to be able to produce both HDR and SDR in parallel with a single team. The typical approach today for broadcasters is to focus on SDR and to let the HDR follow automatically. This makes sense as the SDR output is, of course, still the most important and because shaders are familiar with working in SDR. It is also relatively easy to let the HDR follow the SDR. Doing the inverse is more complex, because the latitude of SDR is more limited, so the 'down-

Abbreviations in brief

UHD = Ultra High Definition. Collective name for the television generation beyond HDTV. Currently typically means '4K' television resolution (3830 x 2160 pixels).

HDR = High Dynamic Range, enables images to be shown with more 'luminance steps'; including more details in the dark and more beautiful highlights.

HLG = Hybrid Log Gamma, one of the two HDR standards. Highly appropriate for live television.

PQ = Perceptual Quantizer, the other HDR technique; uses metadata. Assumes a controlled home viewing environment, like in cinemas.

HFR = High Frame Rate, more images per second, allows for smoother movements. For television in Europe, HFR currently means 100 fps.

WCG = Wide Colour Gamut, extends the available range of colours with more saturated colours ("redder red", "greener green", etc.). Included with HDR.

NGA = Next Generation Audio, a new way of broadcasting audio to provide users with an immersive and personalized sound experience.

ADM = Audio Definition Model, defined in ITU-R BS.2076 as a set of metadata and parameters for all next generation audio technology.



The shader Kevin Joubay (France Télévisions) quickly learned to use the wider luminance range.



The video team.



The audio team.

converted' SDR may turn out to be compromised in quality.

In the Berlin trial the focus was on HDR, because there was no strong SDR-constraint and because the team wanted to make sure to exploit the full HDR capabilities. Overall the HDR production worked well. However, the set-up of converters turned out to be complex and needed careful attention.

NGA: COMPLEX TO MONITOR

The audio production on site was challenging. Not only because it involved the production of three different audio signals in a single control room, but also because each signal in itself consisted of multiple elements: an immersive audio bed and four objects of which the end user can change the volume and position.

The main mix was created using a variety of mics, including a 3D ORTF array, an Eigenmike and many spot mic signals that were provided by the host broadcaster. The objects consisted of commentary and audio description, each in two languages (French and English).

The mixing team used the available height dimension for creative effect; for example, by mixing in mics that were placed near the bar of the high jump, so viewers could hear it being touched above their heads.

The team gathered several ideas for improved visual metering to help future immersive sound audio production. Another desired improvement is to have a serialized form of metadata (S-ADM) suitable for streaming and live productions.

NEXT STEPS

The Berlin exercise has provided a wealth of experience for both the participating EBU Members and the industry partners. A selection of 2160p/100 HLG test sequences are available from the EBU for technical testing. Some of those tests are already planned for early next year, in particular to subjectively evaluate the quality improvements HFR can provide. This is important, as broadcasters have several options to improve their current HD offerings. They can choose which of the new features (UHD,

HDR-WCG, HFR, NGA) they want to introduce. There is no need to add all at once.

So instead of jumping to 2160p/100, a broadcaster may for example decide to start distributing in 1080p/50 HDR, as this saves bandwidth costs. When produced using UHD cameras, the image quality can be very high.

In terms of the production workflow, the EBU is planning to provide guidelines for its Members to help achieve high-quality HDR results, for example concerning equipment set-up and conversions. On the audio side, the EBU is promoting the use of ADM and ADM-based tools to achieve an open technology codec-independent workflow for NGA production deployment. In this context, EBU Tech 3392 provides a constrained production subset of the ADM to simplify implementations and prevent interoperability problems.

The EAC 2018 project will be presented at the EBU Production Technology Seminar 2019.

For more information, see: tech.ebu.ch/eac2018

IRT and EBU show the potential of 5G for media distribution

THE EUROPEAN CHAMPIONSHIPS 2018 PROVIDED AN OPPORTUNITY TO TEST WHAT EMERGING 5G TECHNOLOGY MIGHT OFFER FOR LIVE SPORT DISTRIBUTION.

JORDI J. GIMENEZ DESCRIBES AN IRT-LED FIELD TRIAL.

Broadcasters are actively involved in the development of 5G technology to ensure that it can meet their future requirements and the expectations of their audiences. At present, 5G is entirely based on the unicast transport mode. However, unicast alone cannot efficiently scale to serve large audiences. Although broadcast and multicast are much more efficient ways of distribution, in particular for live events and popular linear services, they have not yet been seriously considered in the 5G standardization process in 3GPP. This might soon change.

The EU-funded research project 5G-Xcast (5g-xcast.eu) is developing an efficient, scalable and sustainable solution for large-scale distribution of media services. Such a solution would integrate fixed and mobile broadband and terrestrial broadcast networks into a unified heterogeneous and flexible infrastructure. Unicast, multicast and broadcast would be used in a dynamic way to provide optimized and seamless delivery of media services. Among the 18 project partners the broadcast sector is represented by IRT, BBC R&D and the EBU.

FIELD TRIAL

To demonstrate one possible means of using mobile technology for the delivery of audiovisual media services, IRT in cooperation with the EBU carried out a field trial in Munich in connection with the European Championships that took place in Glasgow and Berlin in August 2018. The test bed operated by IRT, in collaboration with Nokia and Bayerischer Rundfunk, was configured to deliver several linear television programmes and on-demand content across the city of Munich and the surrounding rural areas. As 5G equipment is not yet available, a state-of-the-art LTE system was used in the trial. An LTE broadcast (eMBMS) signal was transmitted alongside conventional unicast from four broadcast towers in a single frequency network mode. Target receivers were both stationary TV sets and mobile phones.

Audiovisual content came from the European Championships 2018. Live content from the sports venues was received in Munich via satellite and delivered over the LTE broadcast component in an encapsulated MPEG-2 Transport Stream, the same format used in conventional television broadcasts over terrestrial, satellite and cable networks. On-demand content was available over the internet.

The live signal was received, free-to-air, on



both an IPTV set and commercially available smartphones at the same time. Smartphones were equipped with the eMBMS functionality and IRT developed an app that enables tuning to different television channels available in the broadcast stream.

HBBTV APP

In addition to the television channels delivered via the broadcast component of the LTE signal, on-demand content was provided over the unicast connection. For this, the HbbTV standard was used on both the smartphones and the TV sets. On the former the on-demand content could be accessed via the app, on the latter using the red button.

The same concept was demonstrated at IBC2018 using a small-scale LTE base station.

This trial illustrates some of the innovative technical solutions that 5G might enable, including a deployment of 5G on terrestrial broadcast infrastructure. It also points towards new business opportunities that might arise for broadcasters and network operators in the future. For now, 5G broadcast is still work in progress.

“For now, 5G broadcast is still work in progress.”

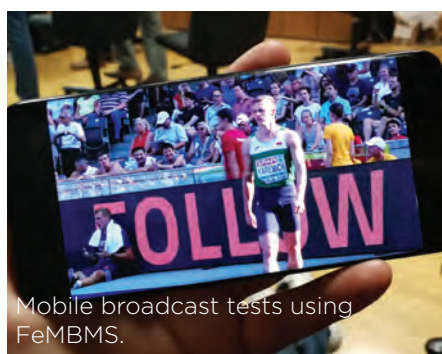
Rai tests mobile broadcast and UHD features

A PAIR OF DEMONSTRATIONS DURING THE EUROPEAN CHAMPIONSHIPS 2018 ALLOWED THE RESEARCH CENTRE OF THE ITALIAN PUBLIC BROADCASTER TO SHOWCASE AND TEST FUTURE BROADCAST FORMATS AND SYSTEMS. **ALBERTO MORELLO**, DIRECTOR OF THE CENTRE, DESCRIBES WHAT WAS DONE.

In the framework of its research in the field of novel broadcast technologies, the Rai centre for technology innovation and experimentation (Rai CRITS) has been investigating the 3GPP standards for video and multimedia transmission to mobile devices. The new advanced wireless communications technologies, known as 5G, promise superior technical performance over existing 4G-LTE with the potential for global economies of scale. 5G may thus be a welcome complement to traditional production technologies and distribution systems, such as terrestrial and satellite broadcast networks. However, for 5G to be useful to broadcasters it must meet their future requirements and the expectations of their audiences.

TESTING RELEASE 14

There is a long way to go, but a significant step towards meeting broadcaster requirements has already been completed: thanks to the participation of EBU Members in the work of 3GPP, Release 14 defines a new FeMBMS profile with characteristics well aligned to technical and functional requirements coming from the broadcast sector to deliver regular mobile TV services. These are characterized by high-quality HD video content at guaranteed QoS, permanently distributed to wide territories (countries, regions). One of the key aspects of Release 14 is the ability to complement the urban coverage of cellular networks with the “umbrella coverage” of wide territories by means of broadcast networks (so-



called high-power high-tower networks).

To showcase their work in shaping advanced wireless communications technologies towards 5G, Rai CRITS and the Technische Universität Braunschweig have together organized a technology trial during the European Championships 2018.

Up to five high-power transmitters on terrestrial broadcast towers operated in a single frequency network configuration enabled the distribution of live HD content, produced by the EBU at the stadium in Berlin, to the Aosta Valley open test bed. The headend at the Rai Aosta premises was fed by satellite. The trial showed how state-of-the-art mobile technologies could be used for the distribution of public service media content and services to mobile devices on conventional terrestrial broadcast network infrastructure, meeting specific broadcast requirements, such as free-to-air delivery, wide-area coverage and cost-efficient distribution to mobile devices.

UHD OVER DVB-T2

A second demonstration implemented by Rai in Aosta was the live distribution of the

UHD/4k High Dynamic Range (HDR, BT.2100-HLG) and High Frame Rate (HFR, 100 Hz) Berlin feed (see page 10) using DVB-T2 and HEVC encoding. These technologies are candidates to replace the current DVB-T terrestrial format in Italy after the release of the 700 MHz band in 2022. Testing, for the first time, HFR mode during a live sports event enabled assessment of its impact on image resolution and motion blur during highly dynamic scenes.

To compare the video quality/user experience versus required capacity, an HD service (still HDR and HFR) was simulcast with the UHD service, HEVC-encoded at 12 Mbps and 25 Mbps respectively. Next Generation Audio (NGA) soundtracks were also broadcast, enabling several features that enhance the user experience. On-field sound was captured in a 4.7.0 format, allowing faithful reproduction of the Berlin stadium atmosphere, while two commentaries and audio description in English and French could be freely selected on the TV set and mixed to the stadium sound bed. The levels could be independently adjusted to enhance either intelligibility or immersion.

Guests who viewed the demo at the Rai regional facilities in Aosta were impressed by the quality of the images and sound. Even if UHD provided the highest quality, the HD version was also highly appreciated and considered a significant step forward compared to the present 1080i format. The NGA features were also judged very important for the success of a new transmission format.

A smarter way to access radio?

VOICE-CONTROLLED DEVICES ARE OFTEN USED TO ACCESS RADIO, BUT THEY DON'T CURRENTLY MAKE USE OF COST-EFFECTIVE BROADCAST DELIVERY. THE EBU IS COLLABORATING WITH NAB TO CHANGE THAT, WRITES **BEN POOR**.

Smart speakers continue to be embraced enthusiastically by audiences and radio broadcasters. Sales of devices are expected to grow significantly during 2019 with newer entrants, such as Apple and Samsung, giving a further boost to the sector.

Of particular interest for radio is the move into the connected car, with voice-controlled assistants appearing in many forms: smartphone integrations, after-market adaptors and as part of a line-fitted entertainment system.

One thing that these devices currently share is their reliance on internet streaming for delivery of audio and their inability to make use of free-to-air broadcast services. This is important for broadcasters in that existing, cost-effective broadcast networks are not being used to serve new audiences on these devices. It also presents a problem for mobile listening, including in cars, with inconsistent mobile data coverage in rural areas and highways and congested networks in cities.

To help address this issue, the EBU has collaborated with the

US National Association of Broadcasters (NAB) on developing a prototype device to demonstrate voice control of broadcast and broadband radio. This Voice-Controlled Radio, unveiled at both IBC2018 in Amsterdam and the Radio Show in Orlando, shows how a listener can access radio services across FM, DAB+ and IP in a unified and consistent way. The ability to use a broadcast signal for audio on such devices enables radio to scale better on these new platforms and opens the path to additional innovative radio applications.

HOW IT WORKS

The device is a combination of custom software and hardware. It's packaged inside a typical table-top radio shell, although such an arrangement could easily be adopted for an automotive environment.

When a user asks for a radio service by its name, the radio will use the underlying voice service (currently demonstrated on Amazon's Alexa) to fetch the audio over an IP connection after obtaining its stream



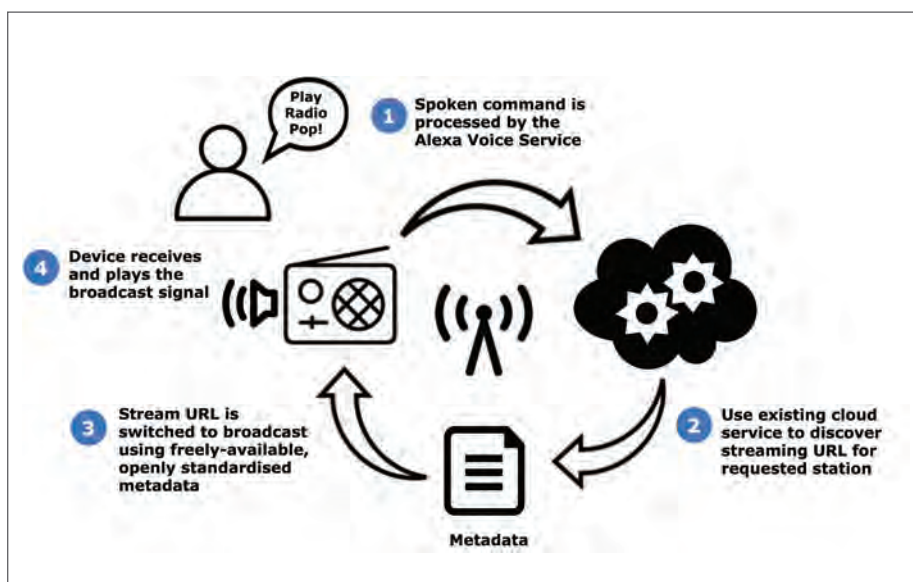
address – the default behaviour.

The radio already knows all of its locally-available broadcast services, having performed an FM and DAB+ band scan. This enables the use of broadcast reception hardware: as part of the scan, the radio performed a hybrid radio lookup (using RadioDNS) to locate openly-standardized metadata supplied by the broadcaster of each service. This metadata includes information such as service names, descriptions and logos (useful for the automotive environment), but also the different ways to listen to that service, over FM, DAB+ and IP. By now linking the stream address to an available broadcast service, the device can activate hardware to receive the service over broadcast, instead of needing to open an IP connection.

FUTURE PLANS

The prototype underlines the need for free-to-air broadcast to be a part of new devices such as smart speakers. The EBU and NAB are working together to help define the future of how radio is consumed.

Both the hardware and software will be released as open source, enabling manufacturers to further kickstart deployment.



DAB at the heart of digital radio

CONTINUING OUR SERIES OF ARTICLES FROM THE EBU'S TECHNOLOGY-RELATED PARTNER ORGANIZATIONS, PROJECT DIRECTOR **BERNIE O'NEILL** PROVIDES THIS UPDATE FROM WORLDDAB.

WorldDAB is the global industry association responsible for defining and promoting DAB digital radio. It brings radio industry professionals together to provide knowledge and expertise that helps countries successfully adopt and implement broadcast digital radio.

These are exciting times for DAB digital radio. In the last 12 months, Norway has completed the switch-off of its national FM services and Switzerland is currently planning its own switchover, scheduled to run between 2020 and 2024. A growing number of markets are committing to DAB+. France has taken significant steps forward in the last year and Belgium can now be considered an established digital radio market. In more mature markets such as the UK, Germany, the Netherlands, Denmark, Italy and Australia, we are seeing significant progress in digital listening and evidence of growth in commercial revenues.

NEW DAB+ LOGO

We are also seeing growing signs of international collaboration. WorldDAB recently announced that the new DAB+ logo is available to use in international markets. Free to industry stakeholders for use in promoting DAB+ to listeners, the new logo will for the first time ensure consistent marketing of DAB+ internationally. Available via the WorldDAB website, the logo will improve consumer recognition of DAB+ across borders.

All this progress is now being recognized at a European level, with the forthcoming European Electronic Communications Code containing a requirement



Bernie O'Neill

for new car radios sold in the EU to be capable of receiving digital terrestrial radio. Our next goal is to encourage individual countries to introduce similar rules for consumer devices. Italy has already done so, and France looks set to follow shortly.

The WorldDAB Technical Committee has recently done work to ensure better implementation of non-Latin scripts in text labels, including embedding right-to-left scripts such as Arabic in DAB receivers. Interest in DAB+ in the Arab

states is high – a survey conducted at the recent Week of Technology jointly coordinated by the Arab States Broadcasting Union (ASBU) and the EBU concluded that more than 60% of delegates expected digital radio to be in place by 2023 across the region.

MEMBERSHIP INCREASING

The growth in the adoption of DAB+ is reflected in WorldDAB's membership, which has grown by over 30% since 2012. Our members come from across the digital radio ecosystem, reflecting our core remit of fostering cross-industry collaboration and the exchange of best practice on the rollout of DAB+ digital radio.

Of course, the world in which we operate is developing rapidly. DAB is not the only digital platform and the key to success is to position DAB at the core of broadcasters' digital strategies. Broadcast has unique characteristics – free-to-air, no third-party gatekeeper and reliable in emergencies. For the long-term health of radio, DAB will help ensure those qualities are preserved in the digital age.



Is NGA anything to shout about?

WILL NEXT GENERATION AUDIO SUCCEED IN THE PUBLIC ARENA? BRILLIANT NEW TECHNOLOGY HAS BEEN DEVELOPED AND ITU DISCUSSIONS ON CONTENT PRODUCTION SEEM TO BE LEADING TO A DEGREE OF CONSOLIDATION, SAYS **DAVID WOOD**.



This is an exciting time! We could be on the threshold of a new age of audio experiences for viewers. It's known that having high-quality sound with a television image increases what we perceive to be the quality of the television image. Tests several decades ago at the EBU showed that the viewer's opinion of the image quality increases by as much as one ITU quality grade when high-quality sound is present.

AUDIO EVOLUTION

Improvements in the sound experience for television have emerged over many decades; from monophonic to stereophonic sound, through different systems of surround sound (who remembers Matrix H?) to the standardized 5.1 and 7.1 surround systems, not forgetting the original ambisonics, the more recent higher order ambisonics, and binaural audio. Finally, the consensus was that the future of television sound lay with 5.1 surround sound. The viewer needed six loudspeakers strategically placed in their viewing room.

But when you talked to many broadcast programme makers they highlighted the drawbacks. Many viewers never used a surround sound set-up or were positioning the loudspeakers haphazardly. Producers could be making pristine versions of 5.1 that would never be heard in their full glory in the home as intended. The programme making community's enthusiasm for providing 5.1 was not huge.

Step forward to 2012, and the emergence in the ITU of Advanced Sound Systems - a technically brilliant set of ideas for providing the ultimate in sound experience for television. The sound would be delivered as a collection of sound elements. These were sound items together with metadata that would instruct the receiver where the point of origin of the sound should appear in the room. It could be anywhere surrounding the listener, and hence the nickname 3D sound. Such

systems, also called Next Generation Audio (NGA), could be used for many other new sound services too.

Although all having the same general principles, several options, different in their details, were available: MPEG-H, Dolby and DTS. Having a plurality of systems that can provide the user with similar experiences never helps speed up the rollout of new technology. One of the barriers to success is that content providers don't know which of the systems to use to make programmes, so they can be reluctant to start.

NGA TIPPING POINT?

Last year, a group of EBU Members and others joined forces to develop a system to offer a single way to make NGA content, the EAR (EBU Audio Definition Model Renderer), which did not come from any of the proponents of the alternative systems.

Discussions followed in the ITU about whether a consolidated version of the alternatives could be agreed for production and monitoring. NGA seems to be moving forward, with the EAR as a potential tipping point.

From time to time I help with BBC undergraduate apprentices, and recently took the opportunity to explain the background to NGA. I asked them to discuss among themselves how successful NGA might be. They concluded that it will eventually be successful, but that it will take quite some time. Viewers have TV replacement cycles usually of about eight years. The home viewing experience is less immersive than the cinema experience, so NGA will not be so powerful in the home.

The potential loudspeaker clutter in the home may be daunting to some. Success will depend on the kind of content available, and how much NGA content is broadcast or streamed. It will be less attractive for phone or tablet users. But, in the end, they thought it will become part of the inevitable march of media realism.

“Having a plurality of systems that can provide the user with similar experiences never helps speed up the rollout of new technology”

Tech giants investing more in original content

A NEW REPORT FROM THE EBU MEDIA INTELLIGENCE SERVICE (MIS) PROVIDES BASIC BENCHMARK DATA ON TEN GLOBAL CONGLOMERATES WITH GROWING ENTERTAINMENT AND MEDIA ACTIVITIES. SENIOR MEDIA ANALYST **FLORENCE HARTMANN** SHARES SOME KEY FINDINGS.

The new MIS report *Internet and Tech Giants 2018* shows how active the tech giants have become in the audiovisual field. Understanding their operational and business models is therefore indispensable for PSM.

Apple, which was ranked the most valuable brand in the world by Forbes in May 2018 for the eighth year in a row, finally entered the original content race in 2018 with a USD 1 billion investment.

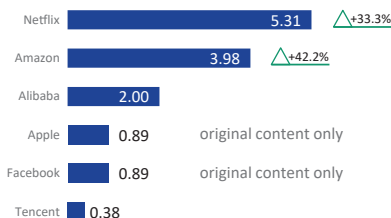
Together with Facebook – which rolled out globally its Facebook Watch streaming service in August 2018 – and Twitter, Apple will try to challenge the two video streaming leaders Netflix and Amazon.

Netflix announced its aim of doubling its European content budget in 2018 to USD 1 billion, out of a total content spend of USD 8 billion. In 2018, the SVoD leader won its first Oscar for the documentary *Icarus*. Amazon, on the other hand, while also collecting awards for its acclaimed original series, has made clear its interest in the

The *Internet and Tech Giants 2018* report consists of a benchmark section, followed by a series of double-page company profiles. It is restricted to EBU Members and is available at: ebu.ch/mis

SELECTED INTERNET AND TECH GIANTS

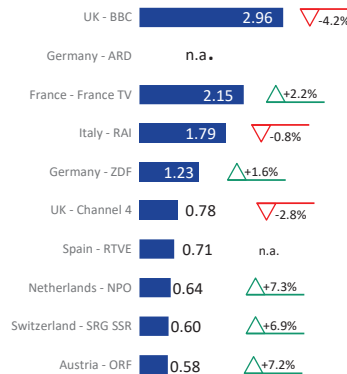
(EUR BILLION, 2017) (% 2016-17)



Content spend: Netflix and Amazon have greatly increased the amounts invested.

TOP 10 EBU PSM IN TERMS OF FUNDING

(EUR BILLION, 2017) (% 2016-17)



sports rights market. The group won one of the UK broadcast packages for the Premier League 2019–2021 and will show 20 matches a season from 2019.

The race for content is also playing out in eSports. Amazon controls the video games streaming leader Twitch, with 100+ million users in 2018. Microsoft acquired Mixer in 2016

and grew the service to over 20 million users by mid-2018. Other major eSports streaming platforms are controlled by internet giants, such as YouTube Gaming (Google) and Facebook Gaming. In China, Tencent has also been investing significant amounts in 2018 in the leading Chinese eSports streaming platforms Huya and Douyu.

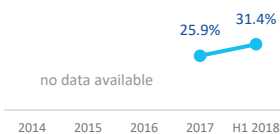
AUDIENCE & SUBSCRIBERS

NETFLIX EUROPEAN MONTHLY REACH

(TV shows/ films/ video watched)

31.4%

In % all internet users 16-64 in 16 European countries (H1 2018)



A subset of the information provided about Netflix in the MIS *Internet and Tech Giants 2018* report. Ten companies are profiled in detail.

NETFLIX NB. OF EUROPEAN SUBSCRIBERS (EU)

26 million subscribers in the EU

(2018)



WEBSITE RANKING

NETFLIX #26 worldwide

.com

(August 2018)

TOTAL SUBSCRIBERS

130 million subscribers worldwide

(June 2018)

A blueprint for more agile media workflows

THE ADVANCED MEDIA WORKFLOW ASSOCIATION PROPOSES A DEVELOPER-FRIENDLY APPROACH TO DEPLOYING MEDIA-RELATED SOFTWARE INTO DEMATERIALIZED FACILITIES.

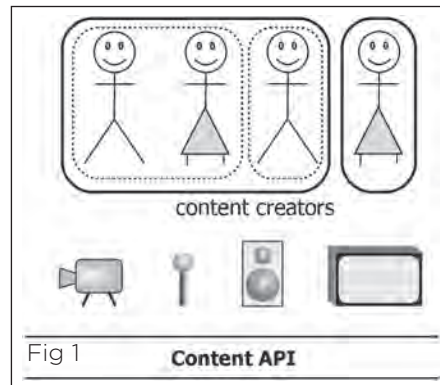
RICHARD CARTWRIGHT (STREAMPUNK MEDIA) AND **BRAD GILMER** (GILMER AND ASSOCIATES) INTRODUCE THE BLUEPRINT.

Data. Lots and lots of data. As creative people move and transform the content they have captured, and as that content is delivered to the consumer, data is the material of the modern media workflow. The parts of the machines that are used to process massive quantities of data are IT systems: computers, storage and networking, both on-premise and using cloud services. These are assembled into useful tools for professional media tasks by software engineers writing applications and services.

Rather than hard-to-change monolithic applications, modern software development has evolved agile methodologies that create microservices. In combination with the adoption of automated testing and continuous integration processes, release cycles introduce new features for internet services several times a day. Hand-in-hand, overall risk has been reduced through the use of frameworks, patterns and/or value-added cloud services that solve common problems up-front, such as scaling, resilience and security.

START WITH PEOPLE

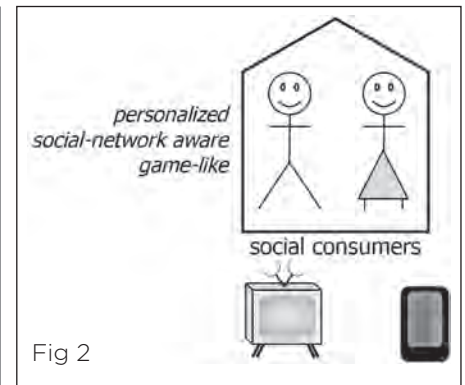
The Agile Media Blueprint (AMB) starts with people, in teams, within organizations and across organizations. It begins here, not only because people are a key component in our craft-oriented industry, but because by starting here, one can address security at the outset. Administrators can assign roles to people and grant them permissions based upon those roles. People in different organizations may be given specific rights in your organization based upon business needs. For example,



personnel from two remote production companies using two different OB vans may be given roles that allow them to collaborate for a one-time event. This approach allows people to securely collaborate using a shared Content Application Programming Interface. The Content API can be implemented to interconnect cameras, microphones, speakers, multi-viewers and control surfaces (Fig. 1).

While the AMB can be deployed to meet professional media production needs, it also may be used to efficiently produce new types of content that require direct interaction with end viewers. The AMB targets social consumers through broadcast media, OTT and mobile (Fig. 2).

Conventional broadcast facilities could never provide individualized content to tens

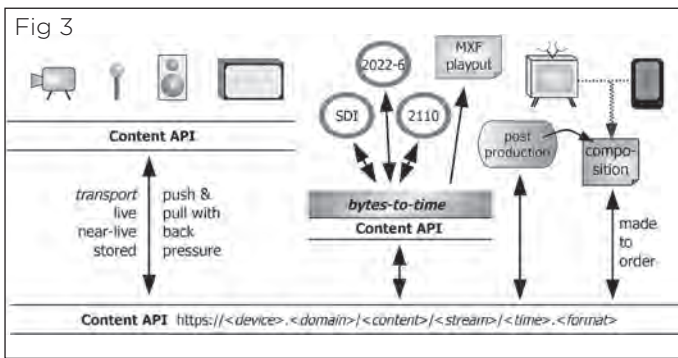


of thousands (millions?) of viewers – it is an anathema to the fundamental concept of “broadcasting”. But to deliver whatever a viewer wants to see when they want to see it means that it is absolutely critical that AMB facilities scale seamlessly. In many cases, in an “individualized content” scenario, content is cached and streamed to the viewer as a one-off event. Many broadcasters are already paying for bandwidth at a cost scaled per viewer, without benefiting from a closer, bidirectional relationship.

MEDIA MADE TO ORDER

The core of the AMB is a grain-based Content API for element-by-element access to the media, backed by best-of-breed cloud-fit technology, including clustered RAM caches, AI and object stores. Microservices make new media elements to order

“The AMB is a plan for how to make use of modern software development practices in combination with currently available cloud services, to build simpler, less risky media-related software that does not compromise on content quality.”



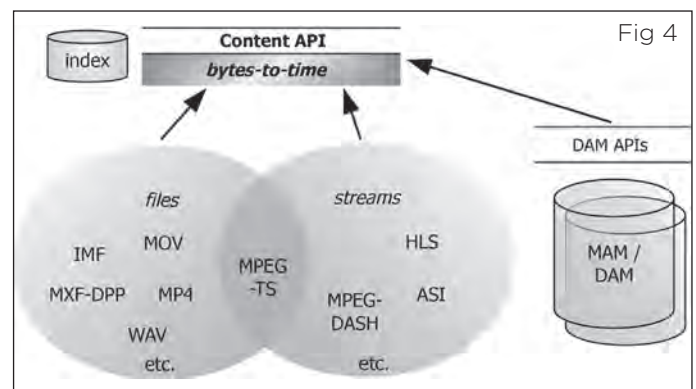
when they are required; no more wasting time and resources by creating media elements “just in case” they are needed.

Media transport in the AMB is between Content APIs, with bidirectional links operating in parallel, faster than, slower than, or at real time. A time-to-bytes translation interface (bytes-to-time component) allows content to be read and written to common signal and file formats, and as described above, allows for compositions to be made on-the-fly (Fig. 3).

Libraries of files and streams can be migrated into an implementation of the AMB, either just-in-time, or according to a schedule, using a bytes-to-time unwrap component, supported by an index database. This allows media factories to easily migrate from a file-based to an API-based infrastructure (Fig. 4).

The AMB is a plan for how to make use of modern software development practices in combination with currently available cloud services, to build simpler, less risky media-related software that does not compromise on content quality. API-based, new formats and devices can be embraced as just another type of data. As with the family of SMPTE ST-2110 standards with NMOS, the AMB remains compliant with the JT-NM reference architecture but starts from the developer-friendly internet platform for ease of deployment into the dematerialized facility.

The AMB is currently a discussion paper from AMWA (Advanced Media Workflow Association) with the intention of introducing it as a project to be led by the association.



IN THE SPOTLIGHT

Józef Wacnik POLSKIE RADIO, POLAND

WHAT ARE YOUR CURRENT RESPONSIBILITIES AT POLSKIE RADIO?

Currently I hold the position of Technical Director at PR and am responsible for all technical processes across the organization. I deal with the management and coordination work related to the planning, deployment and maintenance of technical solutions for production and distribution.

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

As director of the IT department I successfully delivered three key projects that led to me being named “IT Leader 2011”. The projects were: a production and playout system based on Dalet Radio Suite; our Radio Multimedia Database; and a production and distribution system for 100 channels on the internet.

WHAT ARE YOUR PREDICTIONS FOR MEDIA TECHNOLOGY IN THE FUTURE?

In the context of the changing reality facing the media, I think we should focus on cooperation between public service media organizations in the domain of new technologies, such as AI and augmented reality, that will enable the development of the programme offer.

WHAT, FOR YOU, ARE THE MOST IMPORTANT CHALLENGES FACING EBU MEMBERS TODAY?

European society is constantly changing. This relates not just to technology but also to fragmentation and change regarding consumer trends. Citizens are moving away from their traditional frames of reference, shared values and trusted channels for information and entertainment towards a



strong individualism in choosing content.

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

Recently I have been revisiting a passion from my teenage years: I spent two weekends this autumn on the track riding a motorcycle.

PRODUCTION TECHNOLOGY SEMINAR

AN EBU EVENT

29 - 31 JANUARY 2019

REVOLUTIONIZE MEDIA

Technologies and trends that are pushing the envelope on how we produce and consume media, including AI, UHD, IP, and much more.

Seats sell fast; sign up now!

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DIGITAL RADIO SUMMIT

AN EBU EVENT

13 FEBRUARY 2019

SHAPING RADIO'S MULTIPLATFORM FUTURE

'Outside the box' thinking for radio, mapping ways to deliver the medium's full value to all audiences on all platforms.

DRS headlines the EBU Digital Radio Week.

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BROADTHINKING

AN EBU EVENT

26 - 27 MARCH 2019

WHERE BROADCAST MEETS BROADBAND

OTT from A to Z, surveying trends, challenges and opportunities for online media offerings and delivery, with a keen eye on potential game changers like 5G.

BroadThinking covers all relevant technologies, such as codecs, CDNs, players, recommenders and more.

tech.ebu.ch/broadthinking2019

Join us and the industry's leading experts for technology updates, strategic insights and real-world use cases, plus demonstrations and networking – at the EBU's headquarters in Geneva or on our live stream.

EBU