

tech-i

Understanding 5G and what it can be

Plus

- Paths to UHD and HDR
- What place for podcasts?
- Principles for innovation

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Cover story: In this issue of *tech-i* we provide an update on where 5G technology stands currently and related EBU activities, including potential applications for media contribution. See opposite and pages 10-12.

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Our vision for a 5G future

Antonio Arcidiacono

Director of Technology & Innovation, EBU



Imagine, for a moment, a Europe where every citizen, urban and rural, always has the wireless connectivity needed to access high quality media and interactive services. Imagine enabling this with a system that is more universal, cost-efficient and energy-efficient than today's technology allows; a system that can meet not only today's expectations for access to media, but also the emerging world of always-connected self-driving cars.

To build around this vision we are bringing together organizations from across the media delivery chain – broadcasters, public and private, universities, telcos and network providers – to create an exciting and world-beating new kind of media delivery system. It will be one that will use the most efficient technology depending on the circumstances: reception in the home and in moving vehicles; reception in urban and rural areas; delivery to the few and to the many.

In my view, we can only deliver on this promise through the smart combination of cellular mobile networks and broadcast transmitters, terrestrial and satellite. The arrival of disruptive 5G technologies and related infrastructures has the potential to open many new doors: for citizens and industries in Europe and for the global media industry as a whole.

The key concept here is a cooperative network coupled with intelligent receivers. The new arrangement will be able to make use of the power of broadcasting to serve an infinite number of users simultaneously as required, combined with the speed and capacity of 5G internet to provide interactive

and personalized services to individual users. The vast coverage of satellite can be used to serve places where it is inefficient to provide services by terrestrial transmitters. For the user, wherever he or she happens to be, it means continuous, uninterrupted service.

And it's not just the network that is cooperative. Having both 5G one-to-one and one-to-many (broadcast) signals available will mean that services that combine linear (live) and non-linear (on-demand) content at the same time are possible. These can be seen as "cooperative content" options.

In consultation with colleagues throughout the EBU's technology community, we have identified the innovations necessary to deliver on this vision. It starts with the **multilayer 5G network infrastructure** mentioned above; an **enhanced user experience** thanks to a delivery system that can effectively meet evolving requirements; **intelligent receivers** will optimize the reception of available services; **large scale trials**, using popular content from EBU Members, including live sports events, will provide valuable feedback; and, finally, **standardization of the technology** along with industry consensus on its adoption.

It may seem like a tall order, but it's a vision we are ready to embrace. It could raise European industry to the forefront of media technology in the world and, because we will work together in a collaborative project, we can do things that others – including the largest companies in the rest of the world – cannot do.

I encourage you to join us on this journey: it's an opportunity for Europe that's too important to miss.

Voice-Controlled Radio goes open source

The FOSDEM event, dedicated to open source developments, draws thousands of attendees to Brussels each year. This year's gathering featured over 700 talks during the course of a weekend, on 62 different tracks covering topics from programming languages to design. Two presentations in the Open Media room focused on EBU projects: the Live IP Software Toolkit (LIST, see tech.ebu.ch/list) and the Voice-Controlled Radio (VCR).

The VCR project aims to show how a listener can access radio services across FM, DAB+ and IP in a unified and consistent way. It is a collaboration between the EBU and the NAB's PILOT

project, and was first demonstrated during IBC 2018. The focus of the work since then has been to prepare the project for an open source release. Both the software and hardware designs, along with build instructions are now available to the public. The intention is to both demonstrate how the functionality has been achieved and to foster a community around the project, allowing individuals and organizations to build their own devices.

The EBU supports the development of open standards, particularly for radio services.



Contributing prototypes such as the VCR helps to provide a demonstration of how open standards can be used more widely. The EBU has also released its platform for publishing radio service data, using the same open standards, the RadioDNS Manager, as well as a demonstrator client for Android.

Find out more: github.com/NABPILOT/Voice-Controlled-Radio

Recent publications

You can find all of these documents and more at: tech.ebu.ch/publications

NEXT GENERATION AUDIO

EBU R 151 – Recommended strategy for adoption of NGA technology

Tech Report 045 – Why broadcasters need an open, codec-independent workflow for NGA production deployment

The quality of experience of television viewing continues to rise. Sound is a vital part of television and, as well as bringing new heights to the viewing experience, Next Generation Audio (NGA) will enable more services. NGA will offer creative and commercial opportunities for both programme-makers and CE vendors.

R 151 contains the EBU's recommendations to broadcasters and vendors to promote the adoption of NGA throughout the broadcast chain.

Tech Report 045 discusses in some depth the issues surrounding the need for codec-independent workflows for NGA production.

VIDEO TESTING

Tech Report 047 – Testing HDR picture monitors

In April 2018 the Swiss EBU Member, RTS, hosted a group of experts from several EBU Members to perform a series of tests on six professional, first generation HDR (High Dynamic Range) capable video monitors.

This report summarizes several key findings from the measurements, both in terms of overall monitor performance and on what can be improved with regard to the measurement methodology used.



DISTRIBUTION STRATEGIES

Tech Report 046 – Business arrangements for distribution of PSM media content and services

Public service media (PSM) organizations need to develop future distribution strategies that will enable them to fulfil their remit in the face of fast-changing technology, audience behaviour and market and regulatory conditions. In particular, they may seek to maximize their reach while minimizing their distribution costs, given the continuous pressure on their budgets.

Tech Report 046 seeks to facilitate a discussion about the issues at stake, including the implications of "must carry" rules and varying types of business arrangement for PSM distribution.

UPCOMING EVENTS See: tech.ebu.ch/events

- **BroadThinking 2019** 26-27 March, Geneva
- **Metadata Developers Network Workshop 2019** 11-13 June, Geneva
- **25th EBU Technical Assembly** 13-14 June, Cavtat, Dubrovnik
- **Network Technology Seminar 2019** 18-19 June, Geneva

Voting with your eyes – subjective video test results

Two extensive subjective tests were organized during the EBU Production Technology Seminar 2019. Thanks to the active participation of many seminar participants, the tests could be completed within the first two days of the event and the results were announced on the third day. Here we highlight the main findings.

Does HFR really add quality?

The EBU and the IRT tested how viewers evaluate HD (1080p) and UHD (2160p) sports content distributed with “normal” (50 Hz) and high frame rates (100 Hz, HFR). The results indicate more than one point on the ITU-R BT.500 quality scale can be gained by moving from 50 frames per second to 100 frames per second. The result holds regardless of the resolution (HD or UHD) and the shutter angle (180 or 360 degrees). The display used was a state-of-the-art 100 Hz capable 65” OLED television. For this test all internal processing was turned off. More testing is needed to quantify the impact of motion interpolation in the CE display.

How do broadcasting in HD and UHD compare?

Another very clear result of the tests was that there is very little difference in perceived quality between HD and UHD resolution. (See Figure 1.) Producing in UHD,

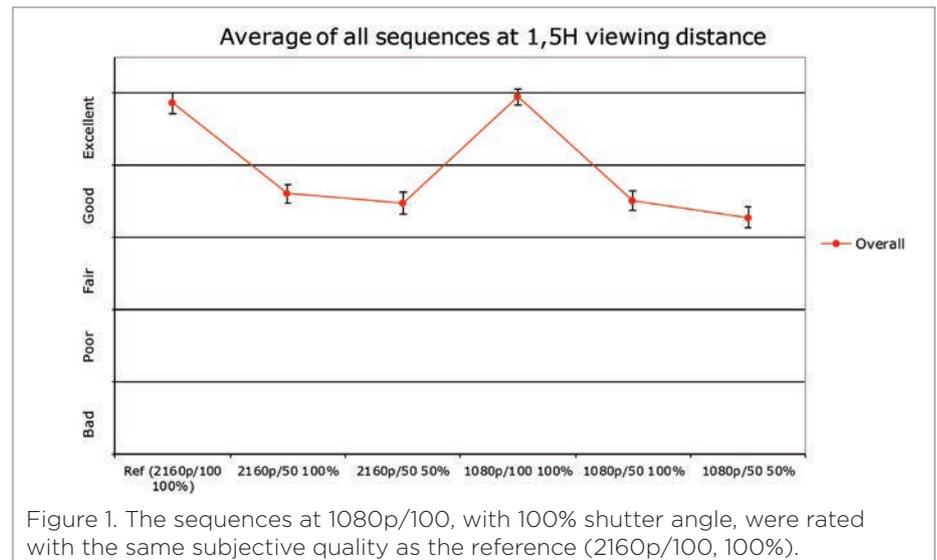


Figure 1. The sequences at 1080p/100, with 100% shutter angle, were rated with the same subjective quality as the reference (2160p/100, 100%).

broadcasting in HD and looking at the result on a UHD display can give results comparable to those obtained when broadcasting in UHD. Scientifically this can be explained by the fact that for the HD distribution both the source (camera) and the sink (display) are applying oversampling.

The results support the approach of broadcasters who are considering 1080p/50 distribution as a bandwidth/quality sweet spot. The tests were performed at a relatively high bit rate (60 Mbps) to avoid coding artefacts. The upscaling was done externally, to be display-agnostic. It would be interesting to repeat the test to determine the most suitable bit rate for distribution.

Do we still need subjective testing?

BBC and Rai experts organized

a second test to see how well the perceptual video quality assessment VMAF algorithm correlates with subjective testing of broadcast material. VMAF stands for Video Multi-Method Assessment Fusion and is a machine learning approach developed by Netflix as an “objective” alternative to human-based testing.

Comparing the VMAF scores with the subjective (BT.500) scores obtained in Geneva suggests the existing Netflix HD model is not optimally adapted to typical broadcast content (e.g. archive content, news). However, even if not perfect, the method could still be helpful in specific contexts, for example to help tune codecs semi-automatically.

For more details, see: tech.ebu.ch/video



Roberto Iacoviello (Rai) and Simon Thompson (BBC) presented the results of the VMAF comparison.



Dagmar Driesnack (IRT) presented the results of the subjective HFR tests.

Four guiding principles for successful innovation

ZDF'S HEAD OF DIGITAL STRATEGY **ROBERT AMLUNG** LEADS AN EBU PROGRAMME WORKING TO UNCOVER THE SECRETS TO SUCCESSFUL INNOVATION. HE OUTLINES SOME GUIDING PRINCIPLES THAT HAVE EMERGED SO FAR.

Finding a way to innovate effectively is a challenge facing every EBU Member in these times of digital change and new audience behaviours. Sharing best practice among Members and learning from each other is the idea behind the EBU's programme Implementing Open Innovation (IOI).

Running since late 2016, the IOI programme seeks to examine and document how public service media and other media organizations take ideas from proof-of-concept to prototype and – crucially – into day-to-day operation, to create value both for the audience and the organization.

With six IOI events now under our belt, we produced an interim report in late 2018. Available to



GET INVOLVED!

The next IOI visits are to Radio France (Paris) in March and Radio-Canada (Montreal) in May. You can find reports of previous visits as well as the full IOI Interim Report on the workspace, which is accessible to all EBU Members. **See: tech.ebu.ch/ioi**

all EBU Members from the IOI workspace, it provides summaries of what was learned on each themed visit, but also sets out

four guiding principles that we believe underpin successful innovation. They are:

1. USE MULTIDISCIPLINARY TEAMS

Small teams should combine editorial and technical staff. This enhances problem-solving capacity, maximizes the possibilities for cross-fertilization of ideas and enables mentoring, for example introducing editorial staff to software development methodologies.

The involvement of design expertise is also important to ensure that UX (user experience) aspects are taken into account from the start.

2. INVOLVE REAL PRODUCTIONS

In an environment where budgets are tight, involving actual productions in innovation processes from the very start can help to maximize the chances of ideas successfully making the transition into daily operation.

They can provide a means of testing new products in real-world conditions and help to ensure that the operational support for products will be available when they are implemented.

3. BE VISIBLE AND TRANSPARENT

Innovation projects should not be hidden away in separate locations. The teams working on innovation should be visible around the organization, perhaps even embedded directly in operational spaces. This provides them with inspiration and helps to increase curiosity among other staff about new projects and products.

Openness and transparency, including with external partners, about the innovation goals and processes can contribute to a positive culture of innovation.

4. FOCUS EARLY ON TRANSFER

There needs to be an early focus on how innovation can be integrated with existing systems and processes. The introduction of new products and processes has knock-on effects for staffing, budgets and the use of other resources.

Involving real productions in the process from the start can generate a pull effect where the business is keen to start using the new product or tool quickly. This can also happen when prototypes are made available for all staff or even the public to use. However, if the transfer process starts too soon it can slow down the innovation,

AI-based audio fingerprinting for music rights reporting

A NEW EXTERNALLY-HOSTED SYSTEM WILL ALLOW ARD, ZDF AND DEUTSCHLANDRADIO TO AUTOMATICALLY GENERATE AND COMMUNICATE MUSIC ROYALTY REPORTS. PROJECT MANAGER **ULRICH GEIGER** (HR) AND ADOPTING AGENT **KATHARINA GIESEN** (BR) REPORT.

In the past, German public service media (PSM) organizations created music reports by hand, about 40,000 per channel per year: a lot of manual work and scope for errors. The latter were due to reporting discrepancies from several legacy systems, misinformation and complex processes. According to the legal framework to use musical works, the broadcasters must pay a flat charge and report at least 90% of all music used to the royalty collection societies, GEMA and GVL. This includes all jingles, sound elements, film music and background music, along with music played on the radio or used to illustrate television productions.

Artificial intelligence (AI) can help solve this complex problem: by analyzing the distributed signal and recognizing the audio used via fingerprints.

COLLABORATIVE PROJECT

In September 2017, following an initial investigative phase and a vote by the responsible committees of all PSM in Germany, a project was initiated in close communication with the collecting societies. An EU-wide bidding process was won by the Spanish company BMAT. The contract was signed in March

2018 and has progressed since then, with implementation inside the PSM organizations, within the vendor and at the collecting societies.

BMAT's music recognition and reporting system permits an exhaustive identification of music broadcast by radio and television 24/7 using its proprietary audio fingerprinting technology. Its music ID detection rate is 98% for clean recordings and 85% for recordings with background noise, with a minimum duration of three seconds. BMAT's platform is fed by audio and video streams and PSM broadcast data, providing identification and auditable reports of music usage in every broadcast production. The reporting interface then gives access to the results and directly sends declarations to the relevant collecting societies.

It became clear throughout the bidding process that a project of such magnitude would require a solid technical infrastructure. Consequently, the so-called Kern-Team (core team) coordinates communication with the 12 PSM organizations and with BMAT. The role of the "Einführungsbeauftragten" (adopting agent) was established at each broadcaster, tasked with communicating the requirements

from and to the core team and to the internal projects.

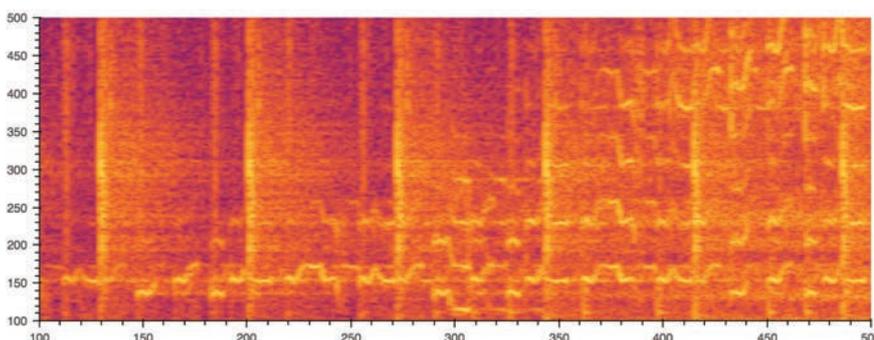
As ARD's existing infrastructure is accustomed to collecting metadata and files, the core team coordinates this as well. For example, the playout centre in Potsdam now collects and refines EPG data, enriched with broadcast transmission data. The developers of the ARD archive database for audio (HFDB – Hörfunkdatenbank) have built a standardized interface to export audio created by the broadcasters themselves (e.g. concerts, jingles).

CARTWHEEL STRUCTURE

Internally the broadcasters have to adjust their technical infrastructure, but more important is the communication and organizational adjustment. As every piece of music used (whatever length and rights) must be documented, misconceptions about the use of music have to be clarified. An editorial structure helps to spread information on how best to do this, according to a number of use cases. One of the changes, for example, concerns the use of signature sounds that must be fingerprinted to be automatically recognized. The pieces of music (metadata and essence) are centrally collected in every organization and then transmitted via one central interface to BMAT. The workflows leading to the central collection are established in every broadcaster individually.

The organizational structure of the project is thus cartwheel-like, and the technical infrastructure mirrors that, based on centralized interfaces. An indication of the success of this approach is that the project is on track to go live in May 2019.

Spectral representation of audio used for fingerprinting



A golden age of podcasting?

PODCASTING OFFERS BOTH OPPORTUNITIES AND CHALLENGES FOR BROADCASTERS, SAYS **JAMES CRIDLAND**, EDITOR OF [PODNEWS.NET](http://podnews.net).

It's a golden age for podcasting, many will tell you. Podcasting is growing like never before, they say: nobody is listening to the radio any more, and we should all focus on the new on-demand technologies.

However, according to Edison Research, 17% of US adults listen to podcasts in a typical week. By comparison, Nielsen tell us that 93% of US adults listen to the radio weekly. The UK sees similar numbers. RAJAR reports that 12% of British adults listen to podcasts each week, versus 90% who listen to the radio in the same time period.

When you compare total time spent listening, the comparisons are even more stark – podcasting is responsible for just 3% of total audio consumption in the UK says RAJAR, and just 2% of audio consumption in the US, according to Edison's Share of Ear study. Broadcast radio, of course, has over two-thirds of our "ear-time".

SLOW, STEADY GROWTH

So why is podcasting gaining so much interest?

It's partially due to steady growth. Podcasting is growing slowly but steadily in every country where it is measured, and the trend lines are clear that it will continue to grow.

It's also partially due to the wide range of content that podcasting makes possible. In Canada, CBC's radio drama unit closed in 2012 but CBC is now producing radio drama once more – in podcasts this time.

It's no accident that broadcasters are the biggest podcasters. NPR leads the way, with 147 million unique downloads in December 2018. I estimate that the BBC is the world's second largest (producing in the English language sure helps). About

a third of the most popular podcasts are, in most countries, from radio broadcasters. Of course, radio broadcasters have a great opportunity: ready-made content combined with easy access to fans of audio.

Podcasting allows broadcasters to achieve several different goals. Podcasting can be used to explore new programme formats, as talent incubation, or as a method of pulling clutter from the airwaves. One Australian broadcaster is successfully producing advertiser-funded podcasts, simultaneously removing advertorial content from their stations, but also getting radio revenue by advertising these new podcasts on-air.

APPLE DOMINANT

The podcast market is, however, immature. About 60% of all podcasts are consumed through Apple Podcasts; the global giant also runs an open podcast directory which feeds many other podcast apps on both iOS and Android. In total, Apple controls nearly 90% of the market. If you get removed from the Apple Podcasts catalogue, as some provocative podcasters have learned, you are removed from almost everywhere. Apple has never monetized its virtual ownership of the podcast market, either. This looks to me like a business risk.

Apple's dominance in this space also means that "discoverability" – how audiences find new podcasts to listen to – is artificially biased towards Apple's Podcast Charts. These are entirely based on new subscribers, not continuing downloads.

Getting accurate data for podcasting's success is made more difficult because of

James Cridland,
editor of podnews.net.



the decentralized nature of podcasting. NPR's RAD initiative has the potential of getting much more granular data into the hands of all podcasters, though some podcast app developers have already refused to add the code.

REPLACING RADIO?

Consumption in-car is still small, but is beginning to grow rapidly thanks to it becoming easier to connect mobile phones to car stereos. RAJAR's latest MIDAS (Measurement of Internet Delivered Audio Services) study appears to point to podcasting having the most listeners at 08:00 – just the same as live radio. There is evidence that podcasting is replacing radio listening for some.

It's tempting to look at podcasting's low consumption figures and say that radio has nothing to fear; that podcasting is more of an opportunity for broadcasters than a threat. However, with changes in culture, audiences and technology, it would be a brave broadcaster that ignores the effect that podcasting could have on their business.

VIEW FROM A MEMBER

Latvijas Radio

People spend hours of their time with a podcaster one-on-one: intimate and isolated from the outside world on their headphones, writes **Linda Rulle**, Head of Multimedia at Latvian Radio. The podcaster should value that intimacy, something we find that linear radio often fails to do. Although usually not as professionally produced as live radio, an individual podcaster can build a loyal following by cultivating their online personality, mostly on social media.

At Latvijas Radio, we publish our linear radio shows as podcasts, but only have one specifically recorded podcast owing to lack of resources. We are currently working on adding more drama series as podcasts, but this will involve overcoming some rights issues.

We plan to invest more in podcasts, as it is a form of media that is here to stay, especially in the context of the potential for future listening on smart speakers. In Latvia, mobile data is widely available and relatively cheap, so we expect significant growth in podcast consumption.



VIEW FROM A MEMBER

Radio France

For our culture-focused radio service France Culture, podcasts are not only a side topic, but a fully-fledged media format, writes journalist **Florent Latrive**. All of our programmes have been distributed as podcasts since about ten years ago and there are more than 24 million downloads of them each month. We have had a 100% increase in two years.

Our focus on podcasts is in line with the identity of our programmes: France Culture is of course a real live radio station, with a morning show and lots of live shows all day long (and our live audience is increasing as well). But we also deliver lots of deep, long and sustainable programmes, knowledge-focused (philosophy, history, science, etc.), cultural ones, documentaries and fiction. For instance, our “podbuster” is our philosophy show, *Les Chemins de la philosophie*, with more than three million downloads a month. In line with these successes, we also launched native podcasts two years ago, programmes distributed only as podcasts, in order to experiment freely new forms of narrative (in fiction and non-fiction), new topics or new rhythms. And it’s just a beginning.



THE EBU RADIO SPORT PODCAST

EBU podcasts for you – available on all popular platforms

The EBU has been exploring podcasts as a format for communicating with Members and the wider media community.

The **EBU Radio Sport Podcast** was launched in 2018 as a means of reflecting the experiences and challenges of radio sport broadcasters around the world. The ninth episode was published in January, with a focus on handball. Patrick Rowlands from NRK Sport and Lars Brøndum Nielsen from DR talk about how they cover this sport both on the radio and on social media. Previous topics have included the World Cup, the Winter Olympics and reaching young audiences.



SKILL BYTES

MediaRoad SkillBytes is a new podcast that explores what the transformation of the media technology environment means in terms of professional journeys: jobs, skills, recruitment, training, etc. SkillBytes is produced by the EBU and BBC in the framework of the Horizon 2020 MediaRoad project, which supports the European media sector by building an ecosystem for innovation. The first episode featured an interview with Léonard Bouchet, Head of Data and Archives at Switzerland’s RTS.



5G: what it is and what it might become

AMID ALL THE HYPE AND PROMISES, IT'S EASY TO LOSE SIGHT OF WHAT 5G ACTUALLY IS AND WHY IT'S RELEVANT FOR BROADCASTERS. **DARKO RATKAJ** (EBU) PROVIDES SOME WELCOME CLARITY.

Why are EBU Members interested in 5G? For the same reasons they are interested in any other new technology, always looking for ways to do their job better. Can 5G help improve the experience of viewers and listeners? Can it enable new services that are not possible, or not practical, with current technologies? Perhaps 5G could help reach new audiences or make workflows more efficient? If EBU Members were to adopt 5G, would it enable them to reduce costs? Or to be better prepared for future challenges?

These questions are important and the best answer we have right now is a cautious *“Possibly yes, provided 5G can meet the Members’ future requirements”* However, such an answer leads only to further questions: What will those future requirements be? And, after all, what do we mean by “5G”?

WHAT WE NEED FROM 5G

It is safe to assume that EBU Members’ requirements, both technical and commercial, will continue to be determined by evolving audience behaviour and expectations, by the changing market environment and by regulatory conditions.

In the 5G context, the onus is on the broadcast community to articulate their requirements and bring them to the relevant bodies, whether standards developing organizations such as 3GPP or regulators and policymakers, both national and European.

Many of the requirements won't be specific to 5G but will be applicable to any technology or network used, e.g. guaranteed signal integrity, predictable quality of service, no gatekeeping, sustainable costs. For these requirements the main question is can 5G meet them and, if yes, can it do it better than the alternative technologies and networks?

It is of course not reasonable to expect that 5G would be the best answer to all requirements, but it is worth exploring where it can play a role. This is precisely what the EBU, together with its Members, has set out to do. This journey has just begun and this is what we learned so far.

A NETWORK FOR EVERYTHING?

5G is a wireless communication system based on a collection of advanced technologies and architectures that can be configured for different

purposes, for example:

- to provide access to the internet;
- to enable control and manipulation of machines (e.g. in an automated factory);
- to connect a network of sensors (e.g. smart electricity meters);
- to support assisted or automated driving;
- to distribute audiovisual media services to the audience;
- to connect cameras and microphones to production facilities.

As 5G networks are software-based and programmable, they can be configured to meet virtually any set of requirements. Of course, not all requirements can be met by the same configuration. However, the network resources can be arranged in such a way as to support a number of different configurations at the same time. This concept is known as network slicing. It could provide unprecedented flexibility, albeit within the constraints of the overall network capacity and coverage.

The telecom industry hopes that network slicing can help unlock new opportunities beyond the consumer market, in particular for professional applications in various industrial sectors (so-called “verticals”) such as automotive, energy, health, manufacturing and media.



“5G is a wireless communication system based on a collection of advanced technologies and architectures that can be configured for different purposes.”

IT'S COMING... SLOWLY

5G is at an advanced stage of technical development and standardization. The first set of technical specifications were completed in 2018 and the first equipment is expected to arrive this year. However, it is important to note that network rollout will take time. 5G functionalities will be deployed gradually, perhaps over the next decade, first on top of the existing mobile networks before standalone 5G networks emerge. The superior performance with very high throughput, very low latency, very high reliability and device density, and very high energy efficiency will only be made available where it is commercially viable.

Nevertheless, 5G is potentially attractive to EBU Members for a number of reasons. It enjoys broad, indeed global support from both the industry and policymakers. It is being standardized on a global level, hence promising unprecedented economies of scale.

Moreover, 5G is still being developed and the EBU, together with its Members, is taking the opportunity to influence this development. We have submitted to 3GPP a set of requirements relevant for content distribution, and a separate one for content production (see page 12). Many of these requirements have already been included in the

3GPP specifications. This work continues.

We are also actively engaged in a number of R&D projects, tests and trials, both national and EU-funded, that aim at evaluating the performance of 3GPP systems and identifying where further developments are required.

NOT JUST FOR TELCOS

While 5G started off as a cellular technology destined to be deployed and operated by mobile network operators (MNOs), there is a growing recognition that one cannot expect MNOs to have the incentive or competence to fulfil all prospective use cases. At the same time the potential of 5G as a technology could be much bigger than initially thought. Therefore, a number of 5G deployment options that go beyond MNO-centric models are being considered, including private 5G networks, or 5G deployment on conventional terrestrial broadcast infrastructure, or on satellite, or some combination

of these. For EBU Members this could potentially offer new opportunities both in content production as well as in distribution.

It is also important to note that at present it is premature to consider 5G as a replacement to any of the existing technologies or networks used by EBU Members. 5G is really about the future. The EBU's efforts are about creating future opportunities for Members and allowing them to make informed technological choices. This will require sustained engagement in R&D projects and 5G standardization in the coming years to ensure that Members' technical requirements can be met.

While getting the technology right is important, it needs to be accompanied by suitable network deployment models, commercial arrangements, and regulatory conditions. These are yet to be found. The EBU seeks to initiate discussions with a range of stakeholders around these topics.

FIND OUT MORE AND GET INVOLVED

Several EBU groups are working on 5G-related projects. Find them at: tech.ebu.ch/groups

Project Group: Mobile Technologies and Standards (MTS)

Standards work, direct engagement with the industry, supporting Members tests and trials, and collaboration with the Spectrum group SPT on network studies

EBU Members only

Project Group: 5G in Content Production (5GCP)

Contributing to 3GPP study on requirements of Audio and Video Production (see page 12).

Open to EBU Members and non-members

Project Group: 5G Deployments

A new group to address non-technical aspects of 5G for public service media.

Open to EBU Members and non-members

Strategic Programme: Future Distribution (FD)

Coordinates all 5G-related activities in the EBU, liaison with other strategic programmes and external stakeholders.

EBU Members only

Helping to unlock the potential of 5G for content production

5G TECHNOLOGY COULD ENABLE CONTENT PRODUCTION WITH INCREASED FLEXIBILITY, MOBILITY AND RELIABILITY, BUT IT WON'T HAPPEN UNLESS BROADCASTERS AND THEIR INDUSTRY PARTNERS SPEAK UP, SAYS **IAN WAGDIN** (BBC), WHO CHAIRS AN EBU GROUP FOCUSED ON THE TOPIC.

You cannot have failed to hear about the latest generation of mobile technologies labelled 5G. It has the potential to have a significant impact on all areas of our lives with promises of high-speed, high quality, always-on connectivity.

As with any technology that improves how we may make content, there is significant interest in how it may be deployed from a wide range of EBU Members, so it is important for us to understand and, where possible, seek to influence its capabilities and when it may be practically deployed.

COORDINATED INPUT

In May 2018, a group of EBU Members, partners, suppliers and other interested parties got together to form a working group on 5G in Content Production (5GCP). At the same time the standards body that oversees mobile technologies (3GPP) launched a study as to the requirements of Audio and Video Production alongside several other studies into other industry use cases. The aim is to identify how 5G may be updated in future releases to best meet the requirements of the industry. The 5GCP group is the main contributor to this study, coordinating input from across the industry.

The mobile communications world is a rapidly changing one and can be described as more evolutionary than revolutionary. It is likely that solutions will appear to replace current cellular bonding technologies deployed on 3G and 4G networks even if we do nothing. These work well for single camera news contribution but 5G has the potential to deliver more

ambitious solutions that may enable the deployment of multi-camera, remotely-operated outside broadcasts as well as the potential to transform our use of radio mics and in-ear monitors in the audio domain. Helping the mobile telecoms industry understand what we do and how we do it means showing that production of a broadcast is far more than a "one-way video call".

As the broadcast industry adopts more IP-based workflows, connectivity that meets our requirements becomes increasingly important. It is therefore very important that we work with key mobile connectivity technologies to ensure that our requirements are understood and implemented in a manner that supports production workflows.

DEMANDING USE CASES

Pairing the potential of the

technology with the threat of spectrum currently in use by broadcasters and production teams being eaten up by future 5G deployments has formed the backbone of the work of the 5GCP group. We have worked to identify how UHD content may be carried at high quality, the very demanding latency requirements of audio workflows and even how the technology may be deployed to cover events over a wide geographical area, such as a cycle race or marathon.

The Audio and Video Production study in 3GPP is in progress and we should see more capabilities, that meet some of our more demanding use cases, defined in future 3GPP releases. In a few years' time it may be possible to not only replace existing radio links used in production but to enable more flexibility, reliability and mobility in how we produce content.



Ian Wagdin spoke about 5G for content production at the Production Technology Seminar 2019. The video is available to EBU Members: tech.ebu.ch/pts2019

Participation in the 5G in Content Production group is open to EBU Members and other interested participants.
See: tech.ebu.ch/groups/5gcp

A pivotal year for preserving our broadcast spectrum

THE ENGINES ARE REVVING UP AHEAD OF THE UPCOMING WORLD RADIOCOMMUNICATIONS CONFERENCE, AS THE VARIOUS PARTICIPANTS FINALIZE THEIR POSITIONS. THE EBU'S **ELENA PUIGREFAGUT** AND **WALID SAMI** EXPLAIN WHAT IS AT STAKE.



The next ITU World Radiocommunications Conference will take place in Egypt this autumn. At the time of writing, the final step on the journey towards WRC-19, the second Conference Preparatory Meeting, is due to see the completion of a report summarizing the studies performed over the last few years. This includes assessments of different solutions to resolve spectrum allocation cases that will be discussed in Sharm El Sheik. In the coming months, national spectrum regulators will define their positions.

Following successive WRCs where frequencies used by broadcasters were given to mobile operators for 4G/5G services, the 2015 conference delivered an excellent outcome. In Region 1 (Europe, Middle East, Africa), the spectrum used for digital terrestrial television (DTT) services, 470-694 MHz, was preserved for exclusive broadcasting use until at least

2023, when the sequel to this year's WRC will take place. At that time, the use of the wider band from 470 to 960 MHz will be reviewed to ensure that spectrum requirements of broadcasters and mobile operators are satisfied and to identify possible regulatory actions in the band 470 to 694 MHz.

DTT: SUCCESSFUL & ESSENTIAL

The frequency band under discussion is the core band of DTT. In Europe, DTT serves over 250 million citizens and remains one of the largest television distribution platforms. Broadcasters have successfully enhanced the platform, using advanced technologies like DVB-T2, MPEG-4 and HEVC to release the 800 and 700 MHz bands for mobile use while maintaining a vibrant DTT platform with many free-to-air and pay-TV services.

In Africa and Middle East, the deployment of DTT has been

slower but today 63% of Sub-Saharan and MENA countries have launched DTT, providing services to a large part of the population.

Ideally, WRC-19 should not result in any change to the current use of the UHF band, nor indeed to the review scheduled for WRC-23. However, it is likely that individual countries or regional organizations may try to pre-empt or influence the possible outcome of WRC-23 by taking decisions on the use of the band at WRC-19. This would be opposed by the broadcasting community, for the following reasons:

1. Investment in DTT networks is still ongoing in many Region 1 countries, in particular in Sub-Saharan Africa; they will need more time and regulatory certainty about the use of the UHF band.
2. The use of the wider UHF band from 470 to 960 MHz by various radiocommunication services, including broadcasting, mobile services and others, will continue to evolve in the years running up to WRC-23. It is therefore necessary to keep all options open and to avoid taking premature decisions in 2019.

While preserving the necessary resources for current investments, EBU Members are investigating possible future distribution methods that could meet the requirements of public service media audiences, including the use of mobile technologies for broadcasting. This is done through active engagement in related developments and standardization activities. And it will allow well-founded decisions to be taken at WRC-23, not before.

ELSEWHERE AT WRC-19...

Other broadcaster-related topics that will come up at WRC-19 include:

- possible restrictions on the operation of satellite uplink equipment without authorization from local regulatory authorities.
- the issue of potential impact on AM radio of Wireless Power Transfer for electric vehicles.
- several allocations requested in the VHF band that may have an impact on broadcasting services.

Peer support on building new broadcaster facilities

THE EBU NEW BUILDERS INITIATIVE TAKES A MULTI-PRONGED APPROACH TO IMAGINING THE FUTURE OF BROADCAST PRODUCTION. ITS NEW CHAIR **NATHALIE JAQUET** (RADIO TÉLÉVISION SUISSE) EXPLAINS WHY.

The way media is produced five or ten years from now – and the physical spaces used – will be very different from today. The changes that are already happening with respect to workflows, technologies, content formats and the work environment will only accelerate, as public service media (PSM) organizations transform, often occupying new or refurbished buildings. Undertaking that transformation successfully is a big challenge for every EBU Member, and particularly for those that are now designing and investing in new facilities.



One of the TV studios at CBC/Radio-Canada's new building in Montréal takes shape. Inset: Nathalie Jaquet, Head of HR Projects at RTS

MONTREAL IN MAY

The next NBI visit, on 22-23 May, is to EBU Associate Member CBC/Radio-Canada whose new Maison de Radio-Canada is due to open in 2020 as a creative hub for the city's digital and artistic communities.

See: tech.ebu.ch/nbi

BUILDING TOGETHER

The New Builders Initiative (NBI) is bringing EBU Members together to plan the future: to imagine media production a decade from now and to define the best ways to get there. Participants are invited to exchange ideas, knowledge and best practices, usually during an on-site visit with a broadcaster that has already started creating new facilities. The programme serves to accompany Members on their journey.

NBI takes a multilateral approach to its mission, drawing on expertise from across the EBU and inviting participants with different backgrounds to engage. For example, the EBU's Technology & Innovation department coordinates work to anticipate the impact of ever more intelligent tools and the increasing "dematerialization" of facilities. The latter trend is a natural outcome of embracing IT, the cloud and IP networks for production infrastructures. This technology-focused work is a

key part of the NBI remit. But the conversation is not limited to technology-related questions. Taking a lead from the EBU Academy, NBI is also examining how Member workplaces are organized and how the change process is managed. The range of skills and competences needed within PSM organizations will evolve along with workflows and new media content requirements. Change management will be an essential element of the transformation process.

BRICKS, BYTES AND BRAINS

The scope of NBI's work takes in topics such as the shift to IP-based production infrastructures, workplaces and spaces – with a particular focus on newsrooms – and project- and change management. Each topic will be addressed from several angles, encapsulated in three words: bricks, bytes and brains.

NBI has been under way for more than a year, with active

participants and several visits already completed, including to BR in Munich, VRT in Brussels and Media City Bergen. I have now become chair of the programme and anticipate that we will continue to organize two to three visits per year. Our next visit, to CBC/Radio-Canada in Montréal, is scheduled for May.

This is an open initiative. It is not limited to those EBU Members that are actually constructing new buildings or facilities; it also encompasses those developing new concepts for how media is produced.

At the time of writing, a survey has been circulated to the more than 100 members of the NBI group (representing 32 PSM organizations), to see where they are with respect to their own projects. The results of the survey will help to refine the focus of NBI in future. We are also very interested in hearing from any Member that would be willing to host a visit within the framework of NBI.

Online traffic: the only way is up

DATA FROM THE EBU MEDIA INTELLIGENCE SERVICE SHOWS CLEARLY THE GROWING IMPORTANCE OF ONLINE DISTRIBUTION. **BRAM TULLEMANS** AND **ALEXANDRA BRENKMAN** HIGHLIGHT SOME KEY TRENDS.

EBU Members have streamed on average 40% more traffic year on year since 2016, according to an annual survey performed by the EBU Media Intelligence Service. The results also show an increase of 25% in maximum bit rates, which vary between 1.5 Mbps for standard delivery and 20 Mbps for UHD content. Other trends are the uptake among Members of Multi-CDN or Hybrid CDNs and the move to control their own Origin servers.

The EBU Membership is very diverse in the size of the audience reached. The smaller broadcasters stream about 0.2 PB monthly while the bigger ones reach 25 PB. Figure 1 shows monthly traffic averaged across Member organizations and the year on year growth of that average.

The questionnaire also dives into other online distribution topics. About 40% of Members deploy their own CDN. This figure is quite stable over the years. At the same time the use of open content delivery networks (CDNs) has increased from 75% in 2016 to 85% in 2018. (Figure 2.) Zooming in on the 2018 dataset indicates that 27% of the open CDN users work with at least two such CDNs and 15% use at least three.

These CDNs are used either to complement their own CDN (hybrid CDN) or as part of a Multi-CDN approach, in which traffic is load balanced and distributed to cache servers in different networks. 40% of the EBU membership is using a third-party load balancing tool to manage this traffic while 17% intend to use one in the near future.

Another online distribution trend is the control EBU Members are taking over so-called Origin servers, which host the publishable content.

Monthly traffic (in PB) averaged across EBU Member organizations

Source: estimates based on MIS Survey 2018

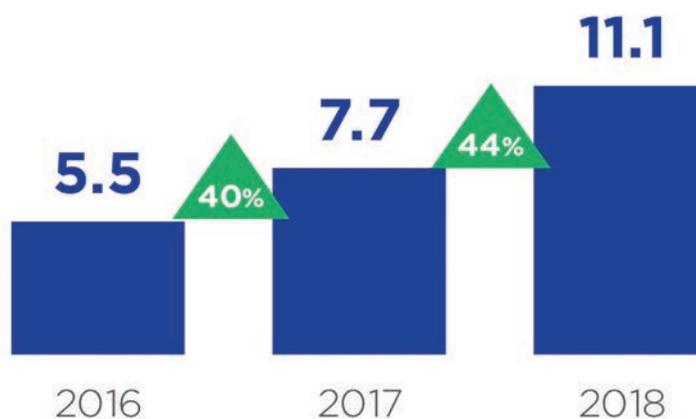
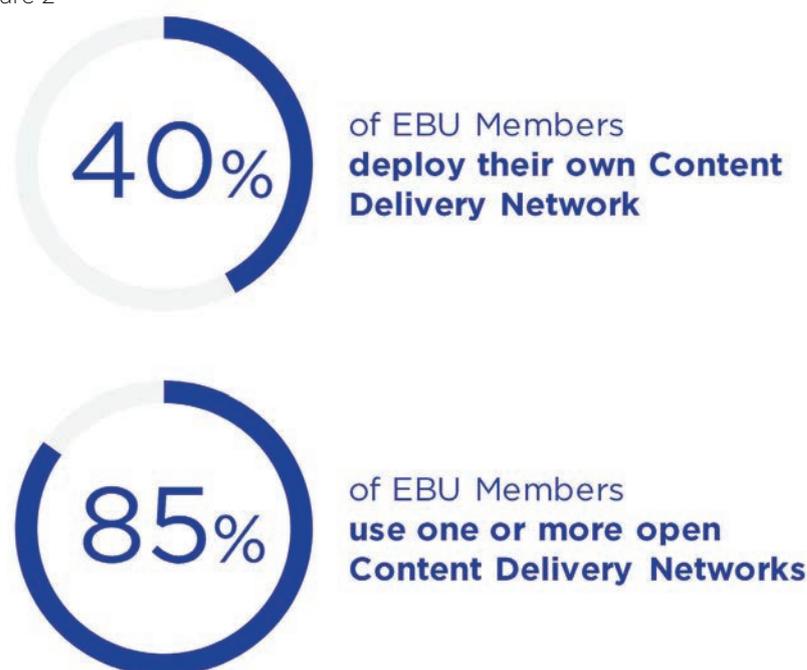


Figure 1

CDNs pick up the media files from this location to deliver it to online audiences. About 70% operated their own servers as of 2018, which is an increase of 12% compared to 2016.

EBU Members can access the full MIS Survey dataset via: tinyurl.com/mis-dataset

Figure 2



Source: MIS Survey 2018, based on 26 EBU Members

How to get the message across to management

THE SENIOR MANAGEMENT OF BROADCAST ORGANIZATIONS, OFTEN FROM A NON-TECHNICAL BACKGROUND, ARE FREQUENTLY IN CHARGE OF IMPORTANT DECISIONS ABOUT TECHNOLOGY. **DAVID WOOD** ASKS HOW TECHNICAL STAFF CAN BE OF MOST HELP.



“Senior management tend to come from a different planet to engineers, one where content and scheduling takes precedence over running code.”

At a recent EBU technology workshop, engineers were asked: “What is the greatest challenge you face today?” Did their response focus on the problems of developing new technology? No, surprisingly and overwhelmingly, they raised problems related to getting their “message” about new systems across to senior company management.

But, on reflection, is it really so surprising? The end product of the broadcast and broadband delivery business is programme content. The public does not buy integrated circuits or black boxes – they buy programmes. While there are exceptions, many of the people at the top of broadcast organizations come from a programme-making background, although sometimes accountants get a look in too. Either way, senior management tend to come from a different planet to engineers, one where the most important things are content and scheduling, not running code. Nevertheless, it is often senior management that take, or shape, policy decisions about what technical system or format to introduce and deliver, so, for better or worse, they have to be convinced about new technology.

THREE QUESTIONS

I was once the secretary of an EBU Digital Strategy Group, which included the sharpest minds among Members’ Directors-General. I was charged with explaining new technology options to them. The DG mindset then – and probably still today – was: “Come back to me when you can explain all this on one side of A4.”

The meetings always took a similar turn. After the presentations, the same three questions were fired off. The first was “How much will this increase my audience?” The second was “How much will it cost to implement?” It was the balance of these two things, they thought, that would tell them what to do. The third question was always “How soon can we have this?” This was

something of a trick question because if the answer was anything longer than “in two years”, the chairman would immediately move on to the next agenda item.

Yet for all of this, getting the message across to senior management about new ideas, and the need to progress and evolve technology and services, is vital. We live in a world of technological determinism, in which technology itself shapes society as much or more than the content it carries. We must try to help senior management to understand this. We must help them to take this into account.

BUILD BRIDGES

Engineers can be blessed with the ability to imagine what *can be* in the future, based on their knowledge of technology. It is not always possible for non-technical people, including senior managers, to do so. This is not a matter of intelligence, but of training and aptitude. They are good at what they do; we are good at what we do. When we come to senior management we must build a bridge to their knowledge base. We cannot assume they are like engineers.

What are the rules of thumb? Make proposals to senior management simple, clear and short. Ensure that anyone, technical or not, can understand them. Engineers are often most interested in how things work; senior managers are interested in what the system can do and what it can provide. This is what they need to hear.

Finally, don’t just rely on paper or oral explanations unless you have to. Prioritize short, sharp practical demonstrations, illustrating what the system can do. Make sure that your demo works – remember the well-known law of technical demonstrations that “if something can go wrong, it will”. Always bear in mind Werner Von Braun’s advice: “One (successful) practical demonstration is worth a thousand expert opinions.”



Partnership for a simpler, more effective content chain

IN THIS SERIES WE HEAR FROM ORGANIZATIONS THE EBU COLLABORATES WITH ON TECHNOLOGY MATTERS. THIS PARTNER PROFILE COMES FROM THE DPP, WHOSE HEAD OF DELIVERY & GROWTH IS **ROWAN DE POMERAI**.

The DPP is the media industry's business network. The DPP's member companies now total over 400, ranging from broadcasters (BBC, Sky, PBS, Viacom) to tech giants (Google, Microsoft, Amazon, Adobe), production companies, post-production houses and start-ups. They join us to benefit from our three key areas of work: events, insight, and technology.

2019 is shaping up to be an exciting year for the DPP. In the autumn, our flagship event the Technology Leaders Briefing will be bigger than ever, bringing together 30 CTOs from the world's most influential media companies (including many from across Europe) to brief the DPP membership on their priorities for the next year. Meanwhile our technical work continues, to deliver a simpler and more effective global content supply chain. One of our biggest workstreams is IMF for Broadcast and Online, enabling adoption of the Interoperable Master Format for broadcasters.

IMF FOR BROADCASTERS

Technology is making the world seem ever smaller, yet perhaps now more than ever, audiences want their locality and their culture reflected in the media they consume. It's increasingly the case that you can't be a global player unless you're a local player too.

Across Europe we're used to the challenges of multiple languages, though it's not only language that drives localization. Disney's hit film *Inside Out* had 45 individual shots edited for differing cultural references. In some markets, hockey was swapped for soccer, while in Japan, protagonist Riley's nightmare food was changed



Rowan de Pomerai

“For the DPP, the publication of a technical document is only the beginning.”

from broccoli to green peppers, because Japanese children love broccoli! As the same challenges become increasingly common in television, we need efficient workflows for dealing with this proliferation of versions.

IMF is a form of “component-based media”, allowing producers and distributors to manage multiple versions of content highly efficiently. For example, in an IMF workflow, you store and manage only the elements of video and audio that are unique between versions, reusing that which is shared rather than duplicating content. This creates dramatic savings in storage and file transfer. Meanwhile the unique identification of every media item and composition means that the

genealogy of content is clear, simplifying content tracking, rights management and QC.

However, the IMF standards were developed primarily for the movie industry, and there are some ways in which they are not well aligned to the needs of broadcasters and online content producers. That's why in 2018 the DPP, working with NABA, published a SMPTE specification (TSP 2121-1:2018) that constrains some elements of the IMF standards in order to support interoperability, and adds features that are important to broadcasters, such as support for ProRes. It also adds options which are important to the European market, such as HLG for high dynamic range, and control track audio description.

FROM SPEC TO IMPLEMENTATION

For the DPP, the publication of a technical document is only the beginning. We are now working with our members to support implementation and deliver real-world business benefits. The “DPP Certified” programme offers interoperability testing and product certification, allowing vendors to demonstrate the quality of their implementations, and helping buyers choose products with confidence. Meanwhile companies from ITV to A+E Networks, BBC Studios to Turner are implementing or piloting IMF in their workflows, and many of them will be showcasing their work with the DPP at NAB in April.

The pace of change in our industry means that collaboration is crucial. The DPP's mission feels more important than ever: to bring together customers and suppliers to solve problems and create opportunities.

The road to UHD: bright ideas and content gaps

FRANS DE JONG CAPTURES SOME OF THE MAIN MESSAGES THAT EMERGED FROM A PANEL SESSION AT THE EBU PRODUCTION TECHNOLOGY SEMINAR 2019.

With SD still around, HD the norm, 4K arriving in the home and 8K in the shops, what does the video format migration path look like for broadcasters? Well, that depends. The national markets across Europe differ greatly and the financial positions and audience targets are not equal either. It also matters whether you are a broadcaster with a public charter or a private one that depends on subscriptions and needs to find new reasons to convince subscribers to upgrade.

During the EBU Production Technology Seminar 2019, representatives from ARTE, BBC, France Télévisions, Mediengruppe RTL, Sky and SRG SSR shared their approaches for moving to UHD and/or High Dynamic Range (HDR).

GRADUAL REPLACEMENT

For Swiss EBU Member SRG SSR the transition to UHD will be a gradual one, driven by HD

“Focusing on providing the audience with HDR instead of “4K” resolution may indeed be the “best bang for the buck” in terms of quality.”

equipment replacement cycles. It will still take many years for all of its facilities to be UHD-capable. For the short/medium term, the organization is interested in moving to 1080p/50 HDR distribution, because it offers a significant quality improvement over the status quo and, as Derya Aydemir (SRG SSR) put it: “It will sparkle!”

Focusing on providing the audience with HDR instead of “4K” resolution may indeed be the “best bang for the buck” in terms of quality. That does not mean SRG SSR will not increase its UHD production, though, as was illustrated by the demonstration at PTS 2019 of

the brand new UHD/HDR IP-based OB truck from the Swiss broadcaster’s facilities house tpc. France TV’s Matthieu Parmentier hopes IP-based facilities will offer more production flexibility, ideally allowing key video parameters (resolution, frame rate, etc.) to be changed on a content-by-content basis.

GOOD WORKFLOWS ARE KEY

Operating mixed production environments, such as for the FIFA World Cup 2018, has proved to be difficult, especially when it involves not only up-/downscaling the video resolution, but also switching between Standard Dynamic Range (SDR)

Matthieu Parmentier (France Télévisions), Frank Heineberg (Mediengruppe RTL), Derya Aydemir (SRG SSR), Lothaire Burg (ARTE), Chris Johns (Sky) and Andrew Cotton (BBC), with moderator Andy Quested (BBC).



and HDR formats. As Andrew Cotton (BBC R&D) pointed out, signal levels and colours can easily go wrong, and tests have shown that the best SDR to HDR conversion is not the inverse of the best HDR to SDR conversion!

Careful workflow design can minimize quality loss, as the BBC's experience during the World Cup showed. By the way: one of the biggest problems is that CE manufacturers are selling dim displays as "HDR", leading to complaints about dark images at home.

UHD CONTENT GAP

Chris Johns (Sky) agreed that the introduction of HDR needs careful preparation, because it cannot be allowed to negatively impact the SDR experience, which reaches the vast majority of the current audience. Sky has learned from its 3D experience that launching a dedicated channel too early can lead to complaints about a lack of new content. The broadcaster has decided there is currently not enough content to fill a complete UHD channel.

German competitor RTL has launched RTL UHD, but treats it as an experimental event channel. The amount of content is limited here, too. The content gap is larger than for the transition to HD, because back then high quality analogue film stock could easily be converted into HD. Other differences are

on the receiving end, where the case to move from an SD 4:3 tube to a flat 16:9 TV was much more appealing for consumers than upgrading from an HD to a UHD display: both are flat and have the shape of a banknote already. In brief: HD was the "perfect storm", UHD is not.

SELLING IMPROVEMENTS

Although technically the impact of the higher resolution may not be the most important to improve quality, marketing-wise it still is resolution that is king. Selling "more pixels" is simply easier to do than explaining the value of buying a brighter TV or one with a higher frame rate (because the refresh rates of the TVs are already confusingly being advertised as 100 Hz or more). It is therefore logical that private channels focus on selling UHD services, while at least three of the public channels (ARTE, France Télévisions and SRG SSR) show interest in moving to 1080p/50 distribution first, gaining valuable time. For ARTE for example, this scenario would help make a substantial quality jump well before its planned UHD transition in 2024.

Nobody talked about 8K, by the way...

EBU Members can watch a video of the PTS 2019 panel discussion on migration to UHD.
See: tech.ebu.ch/pts2019

IN THE SPOTLIGHT

Brian Wynne RTÉ, IRELAND

WHAT ARE YOUR CURRENT RESPONSIBILITIES AT RTÉ?

I am responsible for managing the overall technology infrastructure estate for RTÉ, encompassing IT and both television and radio production and broadcast.

In addition to driving efficiencies and strategic capacity planning, identifying and recommending new technology solutions to best support our business is core to my role.

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

I was a leading member of the small team that brought digital terrestrial television to Ireland. I also led the modernization of RTÉ's transmission facilities, including the introduction of HD to the flagship RTÉ One channel.

WHAT ARE YOUR PREDICTIONS FOR MEDIA TECHNOLOGY IN THE FUTURE?

Video and audio cloud services will mature and continue to grow. AI technologies encompassing machine learning, natural language processing and neural networks will become ubiquitous and will transform media operations and workflows. 5G will deploy, enabling truly fast low-latency mobile IP connections in urban and rural regions.

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

I think the biggest challenge, obvious as it sounds, is generating new revenue streams to enable us to compete. From a technology perspective driving enhancements is expensive and costs have started to move



from capital to subscription or usage pricing models, making it more difficult to sweat assets efficiently.

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

Since running my first marathon in 2009, in memory of my late father, I endeavour to run regularly to keep fit. I also love to ski: there is nothing quite like standing on top of a mountain at 13,000 feet admiring the unquestionable beauty.

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SAVE
THE DATE

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