MEDIA TECHNOLOGY & INNOVATION

ISSUE 37 • SEPTEMBER 2018

tech-i

The changing face of broadcast organizations

Plus

- **PRIORITIZING MEDIA CYBERSECURITY**
- **INNOVATION AT MEDIA CITY BERGEN**
- **INTRODUCING OPEN.RADIO**

and more...

EBU
OPERATING EUROVISION AND EURORADIO

tech.ebu.ch

tech-*i*

Issue 37 • September 2018

3 New Director and Committee
4 Anniversaries of MPEG and DVB
5 Look back at NTS 2018
6 GitLab, GitHub and the EBU
7 Live IP Software Toolkit
8 Software engineering at PSM organizations
10 Norwegian Media Cluster
12 Re-thinking accessibility
13 Introducing open.radio
14 Eurovision Media Services in the cloud
15 Media intelligence for PSM
16 David Wood on competing with giants
17 Partner Profiles: HbbTV
18 Progress on cybersecurity
19 In the spotlight: Michael Eberhard

Cover Story: This issue of tech-*i* is largely dedicated to the increasingly central role of software engineering in public service media organizations undertaking the digital transformation. Start at page 6.

Cover photo by Paul Esch-Laurent on Unsplash

Managing Editor: Patrick Wauthier
Editor: Eoghan O'Sullivan
tech@ebu.ch

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

© European Broadcasting Union

All rights reserved. The reproduction of articles in tech-*i* is authorized only with the written permission of the publishers. The responsibility for views expressed in tech-*i* rests solely with the authors.

Collaboration is the key for the future

Judy Parnall (BBC)
Chair, EBU Technical Committee

It was a delight recently to welcome friends and colleagues from far and wide to the BBC's Salford campus for the Technical Assembly. It was a time to share our experiences and challenges and to find out more about the work of the EBU. There were opportunities for delegates to visit BBC's R&D lab, BBC Sports' facilities, the home of ITV's Coronation Street (the UK's longest running soap opera), or a radical project, run by Manchester City Council, providing training and facilities for media companies. We shared the hosting with ITV and RTÉ and I'm very thankful to all who helped bring together such a successful event.

This was the last assembly overseen by Egon Verharen (NPO) who ended his term as the Technical Committee chair. He has been a dedicated and inspiring leader, encouraging the committee to always remember that we represent the whole of the EBU and not just our own organizations. He leaves with our thanks and best wishes for the future.

On 8 June I had the honour of being elected as the new chair. Egon's will be a hard act to follow, but as a lover and supporter of public service media, I will work hard to do the best that I can. I have had nearly 30 years' experience in broadcasting technology across all services, working in both R&D and also in technology strategy – the interface between business and technology. I now look after BBC's strategy for working with technical standards and industry bodies.

I believe in collaboration – we are better when we work together and learn from each other. It doesn't matter how big or small we are as an organization, we all have something to learn from and teach each other. We have different experiences but similar challenges of constrained budgets and a rapidly changing landscape, with the rise of the West Coast USA giants (who weren't seen as a threat even three to four years ago). David Wood's article (page 16) is really thought-provoking and challenges us to work as one.

We need to make sure that standards function for all of us; that the EBU can exert its influence over how they operate for the benefit of each member organization and share practical experience using them. If we don't, we won't be able to take full advantage of these new technologies.

I don't claim to know everything, but as chair my role is to twofold: to listen and ensure you have input to the workplan through your Technical Liaison Officer; and to help the committee balance all the inputs to find the plan that will best meet as many of your needs as possible, with the limited resources available. We will all need to put in the effort to guarantee that this work can be successfully undertaken. I look forward to Antonio starting and to working with him, Peter, Hans and the team.

Please work with us to pursue a great future for public service media in Europe for the next ten years and beyond.

New Director of Technology & Innovation

Antonio Arcidiacono, EBU Director of Technology & Innovation

Antonio Arcidiacono has been appointed as the EBU's new Director of Technology & Innovation, a position he takes up on 1 September 2018. He has worked as Director of Innovation, and a member of the management committee, at Eutelsat since 2008. With extensive experience in conceiving, developing and taking new products and services to market, he has been responsible for launching innovative IP-based satellite services.

Antonio has a strong knowledge of the European media market. He has worked closely with the leading players in the fields of digital television and multimedia services, as well as with European institutions on technical, standardization, regulatory and competition-related matters. Antonio was a founding member of the EBU-hosted DVB Project and has been a member of its Steering Board since its inception in 1993. Before joining Eutelsat in 1990, Antonio worked for the European Space Agency and he started his career working for Telespazio and Selenia Spazio.

"I'm delighted to be joining the EBU and to have the opportunity to work with all EBU Members, contributing my experience to the development of new ideas and launching successful initiatives to sustain technology and innovation excellence in the media industry," he said. "Maintaining and stimulating public service media as the top quality reference in the market is, and will remain, the key mandate of public broadcasters. I look forward to proposing new ideas and working with Members to launch new initiatives, catalyzing their efforts to grow and be successful in today's challenging and competitive market."

Antonio has a PhD in Electronics & Telecommunications Engineering from the University of Pisa. He is fluent in Italian, English and French.

Technical Committee: four new members and a first female chair

EBU Technical Committee (2018-2020), from left to right: Brian Wynne, RTE (Ireland); Józef Wacnik, PR (Poland); François-Xavier Georget, FT (France); Galina Fedorova, RTR (Russian Federation); Michael Eberhard, SWR (Germany); Thomas Saner, SRG SSR (Switzerland); Kazimir Bacic, HRT (Croatia); Judy Parnall, BBC (United Kingdom); Per Björkman, SVT (Sweden); Olli Sipilä, YLE (Finland); Gino Alberico, RAI (Italy); Grigoris Maliotis, CyBC (Cyprus); Michael Nugent, ERT (Greece).

A new EBU Technical Committee was elected at June's Technical Assembly, hosted in Salford by BBC, in conjunction with RTÉ and ITV. Chaired by BBC's Judy Parnall – who is the first woman to hold that position – the committee includes four members elected for the first time. They are François-Xavier Georget (France Télévisions), Józef Wacnik (Polish Radio), Brian Wynne (RTÉ) and Michael Eberhard (SWR), who is the subject of 'In the spotlight' on page 19. The vice-chairs of the committee are Thomas Saner (SRG SSR) and Olli Sipilä (YLE).

The Technical Assembly is also responsible for reviewing the Technical Committee Workplan. Endorsed at the 2017 Assembly, the two-year Workplan was updated to cover two new Strategic Programmes and the work done over its first 12 months.

EBU Members can access videos and slides presented at the 2018 Technical Assembly: tech.ebu.ch/ta2018

An award for the EAR

Left to right: Michael Weitnauer (IRT), Paola Sunna (EBU), François-Xavier Georget on behalf of Matthieu Parmentier (France Télévisions), Egon Verharen (NPO, former EBU Technical Committee Chair), Chris Pike and Thomas Nixon (BBC).

The team behind the EBU ADM Renderer (EAR) for Next Generation Audio (NGA) was presented with this year's Technology & Innovation Award at the 2018 Technical Assembly. The project, a collaborative effort involving BBC, France Télévisions, IRT and b<>com, is a landmark contribution to the effort to create a fully open system for NGA.

Audio delivery today involves exact mapping of channels in programme production to loudspeaker channels in reproduction. A more intelligent way of assigning audio to appropriate reproduction channels would be to label each snippet or portion of audio with metadata that describes its identity and all necessary technical information required to reproduce it properly. These metadata-enriched portions of audio are known as Audio Objects; using object-based audio alongside channel-based and scene-based audio will enable a truly immersive audio experience and allow for personalized mixes.

Aside from the audio file format and the audio data model (ADM), both of which have been specified by the ITU, along with a range of loudspeaker layouts, the audio renderer has been an important missing link. The job of the renderer is to act on the metadata received and present all the different audio elements to the reproduction hardware.

The commercial giants in the audio industry understandably have their vested interests in defining their own renderer with special adaptations to their own metadata. However, for public broadcasters to be able to take advantage of NGA in future, it is necessary to have an open renderer capable of use directly with ADM metadata. And this is precisely what the award-winning team behind the EBU ADM Renderer has delivered!

Happy birthday DVB!

The DVB Project, which is proudly hosted by the EBU in Geneva, this year marks 25 years of creating the technical specifications that ushered in the age of digital television. The industry consortium is now working on, among other things, specifications for targeted advertising and OTT delivery.

Find DVB Scene magazine at dvb.org/scene

30 years of MPEG

MPEG has become a brand name for many things that are digital audio and video, *writes Moving Picture Experts Group chair* ***Leonardo Chiariglione*** (pictured above). Its presence is felt by billions of end users, many of whom do not even remember what audio and video were when the prevailing technology was analogue. MPEG's presence is also pervasive in all industries that provide products, services and applications for digital media.

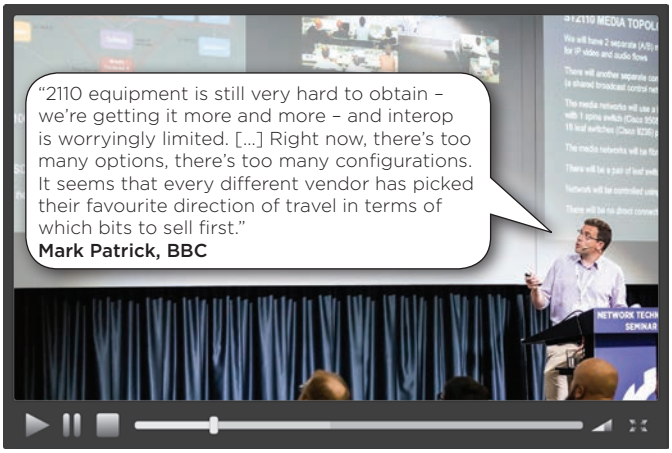
But what is MPEG? Thirty years ago it was a group of fewer than 30 people working on what has become known as MP3 and on a video compression technology called MPEG-1. The latter has brought digital media to hundreds of millions of people as a means to store audio and video on compact discs but is no longer in use because four generations of video compression standards have followed it. Today MPEG is a group with some 1,500 registered members, a third of whom participate in quarterly meetings where they work on some 20 different tracks of work to apply compression technology to a broad range of fields. Lately they have focused on immersive applications, but also non-media data such as point clouds, genomes and neural networks.

Why has MPEG been so successful? Because most of the information around us is in digital form and most of what is not digital now will soon be converted to that form. Compression, however, is what makes digital data usable: being digital is good but being compressed digital is much better.

See: blog.chiariglione.org/30-years-of-mpeg-and-counting/

NTS 2018: who said what?

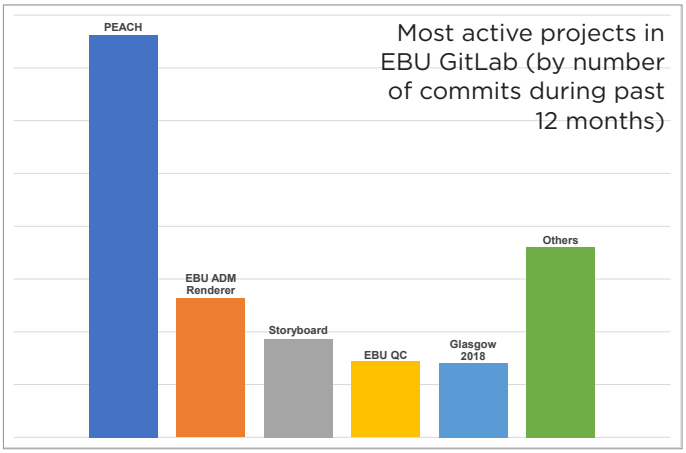
FOR TWO DAYS LAST JUNE, THE EBU NETWORK TECHNOLOGY SEMINAR HOSTED THE WORLD'S FOREMOST EXPERTS IN LIVE IP PRODUCTION INFRASTRUCTURES. HERE'S JUST A SMALL FLAVOUR OF THE PROCEEDINGS.

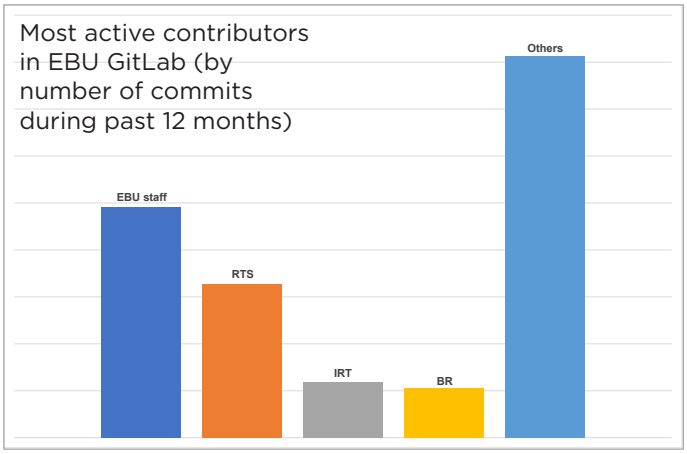


EBU Members can access all videos and slides at: tech.ebu.ch/nts2018

GitHub, GitLab and the EBU

WITH SOFTWARE PLAYING AN INCREASINGLY CENTRAL ROLE IN THE OFFER OF PUBLIC SERVICE MEDIA ORGANIZATIONS, THE EBU HAS EXPANDED THE TOOLS IT OFFERS TO SUPPORT THE DEVELOPER COMMUNITY, WRITES SOFTWARE ENGINEER **YURY BRUKAU**.





Over the past few years, the number of EBU activities that involve at least some element of software development has increased significantly. Hand-in-hand with this, several tools have been made available to Members and often to the wider community for hosting, sharing and discussing code. The principle tools to mention are GitHub and GitLab.

WHAT IS GIT?

Version control is a fundamental part of the workflow in software development. It enables developers to work together effectively, being able to collaborate on the source code of their projects. While the Git version control system (created by Linus Torvalds of Linux fame) was a starting point for better code collaboration, GitHub made it even easier.

GitHub was founded 10 years ago, and it is now hard to find a software engineer who hasn't heard about it. By applying modern communication features inspired by social media sites, GitHub empowered social coding. It provided the first truly accessible UI to manage and review feature branches, and the ability to merge them with one-click "pull requests". As a result, open source projects flocked to GitHub as a place to not only host code but to grow a community as well. Alexa.com lists the GitHub.com website as being 64th in terms of web traffic globally and 34th in the US. The recent acquisition of GitHub by Microsoft validates the growing influence of software development.

EBU Technology & Innovation uses GitHub to host open source projects. Visitors to the EBU page on GitHub (github.com/ebu) can find more than 80 repositories relating to a variety of different projects. To mention just three examples:

- github.com/ebu/awesome-broadcasting provides a growing list of references to open source projects related to the broadcast industry.
- github.com/ebu/ebu_adm_renderer is the reference implementation of the EBU ADM Renderer for Next Generation Audio (see page 4).
- github.com/ebu/pi-list is where you can find LIST, the Live IP Software Toolkit (see page 7).

HUB VS LAB

While GitHub is open to the whole world, EBU T&I also manages an installation of GitLab (git.ebu.io) for projects where access is restricted to EBU Members. The main difference between GitHub and GitLab is in the vision of the two products.

The core features of GitHub are about collaborative software development and sharing, and it is also possible to use third-party tools integrated with GitHub for continuous integration, deployment, etc. The goal of GitLab is to provide a single application that does everything from planning to monitoring. GitLab is itself open source software, available for self-hosting. (The Microsoft acquisition of GitHub was reported to have prompted a significant number of projects to migrate from the former to GitLab.)

Our GitLab installation is integrated with the EBU's single sign-on system, which makes it very easy for anyone with an EBU website user account to access projects developed in the context of the Technical Committee's strategic programmes. The projects already hosted on git.ebu.io include the following:

- PEACH, the single sign-on and recommendation system co-developed by several EBU Members.
- EBU.IO/QC, a tool providing access to over 300 QC test items.
- Storyboard, a tool allowing Members to convert their audio clips into video content to share on social networks.
- A web application for the Glasgow 2018 European Championships, to ingest and show sports data using a semantic database.

Are you on the LIST?

ASSISTING MEMBERS IS A TOP PRIORITY FOR THE EBU, PARTICULARLY WHEN IT COMES TO DEPLOYING THE NEWEST TECHNOLOGIES. **WILLEM VERMOST** AND **IEVGEN KOSTIUKEVYCH** INTRODUCE A TOOLKIT FOR THE EARLY ADOPTERS OF LIVE IP.

It is very hard to know and to grasp what is going on in an IP network in a media facility. One cable no longer represents one signal. The well-known "black and burst" and SDI are replaced by PTP* and Live IP. Early proofs-of-concept and the first fully fledged, up-and-running IP-based facility in Luxembourg all confirmed the need for tools to help understand what exactly is going on in the Live IP network.

The Technical Committee's workplan included the goal of developing a test and measurement regime for IP in live production. In the meantime, the EBU had been actively participating in the work that resulted in the SMPTE 2110 standard for elementary streams in managed IP networks. Suddenly the stars aligned: an identified need for test and measurement in Live IP networks and deep knowledge about the upcoming standard.

YOUR IP WATCHDOG

Having needed to understand the emerging standard in detail, we were ideally placed to build a demonstrator in Python to check a few core parameters of the specifications. During the interoperability tests organized by the JT-NM (a joint effort between the EBU, AMWA, SMPTE and the Video Services Forum), we were more or less the 'watchdog', to confirm whether senders/streams were behaving well.

A Python script is a nice thing. But when the interoperability test scaled to more than 50 vendors, many bringing multiple pieces of equipment, something more powerful was needed. Together with our go-to IP expert Pedro Ferreira and his team at bisect, we started building a C++ optimized version of the Python script. Once the base of the code was ready, there was plenty of flexibility to extend and adapt. The result is an open framework with 'workers' to decode all the needed details. If a new standard arises, a new worker can be plugged-in to the framework.

The most important part is the fact that we abstracted away all the complexity of needing to understand the smallest details. A graphical interface helps the user to understand the state of the link being monitored. It gives an overview of the number of streams and automatically detects the type of stream (PTP, video, audio or ancillary data).

A LIST WITH POTENTIAL

We began to realize LIST (as our Live IP Software Toolkit is now known) could be very helpful during the vendor selection process, the project deployment/debugging phase, or even just to start learning about the technology to be used in your future Live IP facility. At NAB 2018, we presented a white paper and were asked to demonstrate our tool at the IP showcase.

We have also made the code publicly available on our website (tech.ebu.ch/groups/list). We understand that it can be hard to find an engineer who will be able to compile the code (software developer), understand how use it in your network (network/IT engineer) and analyse the results of all the tests (broadcast engineer). For this reason, we plan to provide 'containers', with an easy script to deploy.

We're not there yet but LIST has the potential to become a Live IP distributed monitoring system. We strongly believe such a need will arise the first day you install a Live IP system. We've taken this project as far as we can with the available budget. By using the tool and giving feedback you can help the EBU community to bring LIST to the next level. Further development is in your hands!

More information: tech.ebu.ch/groups/list

* Precision Time Protocol, SMPTE ST 2059

PSM approaches to software development

AS SOFTWARE DEVELOPMENT TAKES AN INCREASINGLY CENTRAL ROLE IN PUBLIC SERVICE MEDIA, WE'VE ASKED THREE EBU MEMBERS – FROM SWEDEN, ESTONIA AND SWITZERLAND – TO DESCRIBE THEIR ORGANIZATION'S APPROACH.

Gereon Kåver

DEVELOPMENT MANAGER
SVT INTERAKTIV, SWEDEN

Most of our product development is done by SVT interactive, which has about 15 teams and three main departments, Video Streaming, News and Children. We have chosen to keep it together as we believe the competence and inspiration flow are essential. Each department is sitting next to the corresponding broadcast organization though, as we think we need to work together to meet the user needs.

We develop most of our products in-house as we believe that product development is a long-term commitment towards meeting our audience, and knowledge about the user is as important as development skills. All teams are cross-functional and autonomous and choose how to and what to develop to move towards their goals.

One of the most recent challenges for us is to work in a more data-driven fashion, in development, content production, editorial planning and marketing. Growth Engineers have come to be important change agents in that transformation. Combining this competence with User Experience is essential in meeting user needs.

Developing digital products requires constant learning and testing new iterations. I believe a culture of learning is essential, both when it comes to technology but also for testing hypotheses to learn more about the users.

Individual curiosity is a necessity working in a fast-moving environment. That's an important quality we look for when seeking new experts for all our teams.

Gereon Kåver, SVT

We are quite agnostic when it comes to testing new frameworks and solutions. Each team can choose whatever they find is the best fit for the task.

Recently an open source competence team was created, which has the goal of experimenting around open sourcing. We think that is good both to learn from other developers and to connect to the developer community. We also feel that it relates to our public service values.

In the rapidly changing environment in which we operate, learning is a key factor for survival. I believe we have a lot to learn from each other as broadcasters and EBU Members, both successes and also less successful experiments.

Jaanus Lillenberg

ICT DEVELOPMENT DIRECTOR, ERR, ESTONIA

ERR's general approach to software development is a mixed one. If we have a reliable partner and dedicated functionality, we leave it to the partner. However, these cases are few and far between. Most of the software development takes place in-house. We run a development department of 15 people. Nine of them are programmers and the rest are designers, project leads and product support people. There is a saying in the department about outsourcing: we outsource the development only if we have all the means and ends to do it by ourselves. This means the only reason to that specific job is to save time.

It is hard to find expertise for products written in rare and obsolete languages. It's also a struggle to recruit support developers for products that are broadcast-specific, owing to the virtually non-existent market size in Estonia.

With regard to upskilling or reskilling of existing technical staff, there are opportunities for a programmer to evolve, for example either to a low-level architect/programmer or in the direction of team lead or project manager.

Open source software is heavily preferred in terms of tools: operating systems, database servers, caching, web servers, streaming solutions, streaming players, etc. The core product, however, is developed in-house. For broadcasting and radio integration development, which are also covered by our developers, we really look to the policies of the production software company.

Jaanus Lillenberg, ERR

I really appreciate the EBU Flow and EBU PEACH projects as examples of opportunities to collaborate with other broadcasters. This is how we should tackle all future problems – develop and provide solutions for future challenges from one place and make them available on agreed terms. I also see great potential in exchange programmes for software developers. This works well for Nordic countries already and we are aiming in that direction as well. Learning the workflows of other organizations and solving challenges together provides insight both for the receiving organization and for the visiting developer.

Mathias Coinchon

CHIEF TECHNOLOGY OFFICER
RTS, SWITZERLAND

At RTS software development is mainly handled in the department that's in charge of our digital and online offer, for the development of our apps and web products. We have a team of in-house developers that can be complemented by freelance programmers (provided by external companies) when new products are developed or more staff is needed. The freelance programmers are sometimes hired into the company.

There's also a team of in-house DevOps in the operations department, performing integration and small-scale development and configuration of information systems used for media production.

The DevOps team is often overloaded with requests and projects for digital products or new information systems for production. Hiring skilled profiles and training them to understand all the architectures and different in-house systems takes time. It is also sometimes difficult to hire as the salary base in media is lower than in the financial or telecommunications sectors. With the transition to IT and IP in media production, it will also be necessary to increase the number of skilled IP network engineers we have available.

Staff have opportunities to undertake training and to request courses but complete reskilling would require much more time and is more complicated. For example, a programmer can do courses, sometimes self-led, to learn a new language but that would be more difficult for technical staff and engineers who don't have a programming background.

In broadcast operations we use very little open source software – it's not usually in the culture of broadcast engineers to build systems based on open source. They prefer to rely on closed-source solutions from trusted manufacturers, adapted through configuration or requests to the manufacturers. The strategy in broadcast is to use products that have open APIs and that implement industry standards, so that we can adapt as required and avoid vendor lock-in.

It's very different for the digital team, where they make/build their own products and use a lot of open source components to do so. Very often these open source components are their de facto standards. This approach also offers a way to find programmers on the market.

When it comes to software, there are certainly lots of opportunities for collaboration with other broadcasters; it's difficult to list them all here. It can sometimes be hard to synchronize with other broadcasters that have different sizes, structures and cultures. Furthermore, in some areas there are good solutions provided on the market by manufacturers, so collaboration offers few benefits. So, the first step is to identify where there are gaps and where it's necessary to make instead of buying. It can be because there's no product on the market that fits the needs; or because solutions are either too costly or are closed; or it may be a strategic matter where it's necessary to adapt very quickly to the business with a team of in-house programmers.

The next step would then be to define what can be shared, how, and to weigh up the cost of collaborating versus the cost an in-house only approach. For example, for our SOA (software-oriented architecture) approach for production systems, it would be useful to find other broadcasters that have implemented components for systems on the market that we could re-adapt. Collaboration takes resources and time for those who have created software – for packaging, documenting, communicating – this can be difficult without sufficient resources.

RTS is active on software collaboration with other broadcasters by being one of the biggest supporters of the EBU's PEACH project, used for our recommendation system.

TV 2 news studio with robotic cameras.

Collaboration is the new business model

THE BERGEN-BASED NORWEGIAN MEDIA CLUSTER IS A WORLD LEADER WHEN IT COMES TO MEDIA TECHNOLOGY, WITH 82% OF CLUSTER COMPANIES LAUNCHING NEW INNOVATIONS ANNUALLY. **ANNE JACOBSEN**, CEO OF NCE MEDIA, EXPLAINS WHY IT HAS BEEN A SUCCESS.

The Norwegian Media Cluster has evolved into an exciting international environment, with more than 100 companies as members, including six major universities and research facilities. The cluster is a world leader when it comes to augmented reality, graphics, visualization, digitalization, broadcast and television technology. Key players include Vizrt, Vimond, Mediability, Sixty, Highsoft, TV 2 and NRK (both EBU Members), Bergens Tidende, BA and The University of Bergen (Department of Information Science and Media Studies). The Media Cluster creates tools that the media industry needs to be able to tell stories better, faster, in a more targeted manner, in the right context and in the right way.

For years Bergen has offered a powerful environment for media technology, with large global market shares, world-leading solutions and a high pace of innovation. Several reports and research have shown that that the Media Cluster compares positively to national averages in most areas and has developed more effectively through the years. The Media Cluster has its own, very special dynamic, which results in rapid growth and value creation – and now also spills over into other sectors, as all businesses need to relate to digitalization, visualization, artificial intelligence and new business models.

MEDIA CITY BERGEN

Large parts of the Norwegian Media Cluster are now co-located in Media City Bergen, a leading, international hub for media and technology innovation, and a landmark building in Bergen. The new science and media hub, spanning more than 45,000 square meters, is the workplace of 1,200 people in the media industry. A variety of events are held there, from live broadcasts, debates and interviews to student pitches, seminars, conferences and trade shows.

All of the companies hosted by Media City Bergen are in the Media Cluster. This includes the global leading companies working in graphics and broadcast solutions and the small companies working in a variety of other fields (augmented reality, 360video, 3D, animation, VR, AI, blockchain, game and app development, drones, beacons and sensor technology).

In the south tower you will find MCB Media Lab, as well as a start-up lab for entrepreneurship and business development. Finally, the new science park also serves as the campus for 220 students from the University of Bergen, studying broadcast production, UX design and journalism.

MCB MEDIA LAB

All members and partners can use the state of the art MCB Media Lab for innovation projects, research, workshops, prototyping, testing or product development. It also allows the cluster companies to meet the Media Lab partners, DeloitteDigital, IBM and Sparebanken Vest, and to access Bergen Media Platform: open data, APIs and technical platforms from cluster companies and international tech partners that students, start-ups, researchers,

NCE Media

teams and project developers can use as their sandbox. As IBM is the selected technology partner for the cluster, its cognitive technology Watson is also available.

In this way the Media Lab represents a vital tool for developing a strong, global industry, enhancing innovation and seeding future successes.

MEDIA INNOVATION ENGINE

NCE Media – Norwegian Centre of Expertise in Media – is the innovation engine for the cluster members, part of a government-supported programme from Innovation Norway. NCE Media has six full-time employees that actively work to enhance activity in the cluster and facilitate innovation processes among members, as well as programmes for partners and sponsors. It runs the Media Lab as well as other innovation projects and activities in the Media Cluster. The team typically helps members to boost their innovation projects, facilitates different activities, and helps position innovation projects for funding from different grants.

SUCCESS

Our success is due to the will to cooperate. Even competitors will sit down around the same table, share ideas and projects. This is unique in the Scandinavian context, and especially prominent in the Media Cluster. By cooperating, the companies can build stronger products and services, linked together in a way that makes for a strong international presence. In addition to this, the Media Cluster houses the whole ecosystem, allowing developers to test new products and services on potential clients and get continuous feedback during the development cycle.

The international conference mcb tech, part of Media City Bergen Future week, is held annually in June. It's worth a visit as it brings internationally renowned speakers and captivating presentations to further boost competence and innovation throughout the cluster.

A view of NRK's offices from the Media City Bergen atrium.

EBU MEMBERS IN THE MEDIA CLUSTER

Both of the EBU's Norwegian Members are located in Media City Bergen: TV 2 with their headquarters and main operations; and NRK with their regional branch for the Norwegian West Coast, NRK Hordaland.

The strong innovation focus at TV 2 is evidenced by the many media technology spinoffs it has given rise to: Vizrt, Mosart, Vimond, Wolftech and Electric Friends all arose from the broadcaster's desire to create tools that enable fast and cost-effective workflows.

TV 2's new facilities in Media City Bergen are designed to enable scalability and flexibility in a rapidly changing media environment as well as managing the daily operation of seven linear channels. TV 2 opted also to go full IP as part the move, to avoid having to install dual systems. The on-site production facilities consist of three large studios and one small studio, a news studio in the editorial space with new robotic solutions from Electric Friends, five control rooms, Quantel NLE, and full file-based workflow enabling highly automated production flows for the multifunctional editorial staff.

NRK is located in the mid tower at Media City Bergen, accessible directly from the main entrance and atrium. Over 3,600 square metres, 140 people have their workplace at NRK Hordaland. The facilities include state-of-the-art studios: two radio studios and a TV/multi-use studio. NRK Hordaland broadcasts six hours of radio every day, and also has a substantial online news operation. NRK Hordaland is NRK's biggest TV production facility outside its headquarters in Marienlyst, Oslo.

Is it time to rethink accessibility?

BY ADOPTING A MORE ALL-ENCOMPASSING VIEW OF THE USER EXPERIENCE, BELGIUM'S VRT HAS FOUND THAT ACCESSIBILITY IS ADDRESSED MUCH EARLIER IN THE DEVELOPMENT PROCESS. UX DESIGNER **MARC WALRAVEN** EXPLAINS THE APPROACH.

VRT strives to design and develop digital products that offer an optimal user experience (UX) to the widest possible audience. It sounds logical but we needed to tackle an important showstopper: digital accessibility was often perceived as a separate layer for our products and considered too late in the process (or even after the product launch).

As an experiment, we decided to no longer emphasize the accessibility of a product. Instead we started calling it "the product's fully-fledged user experience":

a logical and intuitive user interface, supported by an attractive and well-organized design, with relevant, up-to-date and qualitative content, and supporting all forms of user interaction.

This definition reflected well our goal of considering every type of (user) interaction, such as keyboard navigation, speech commands, screen reader output, screen magnification, etc.

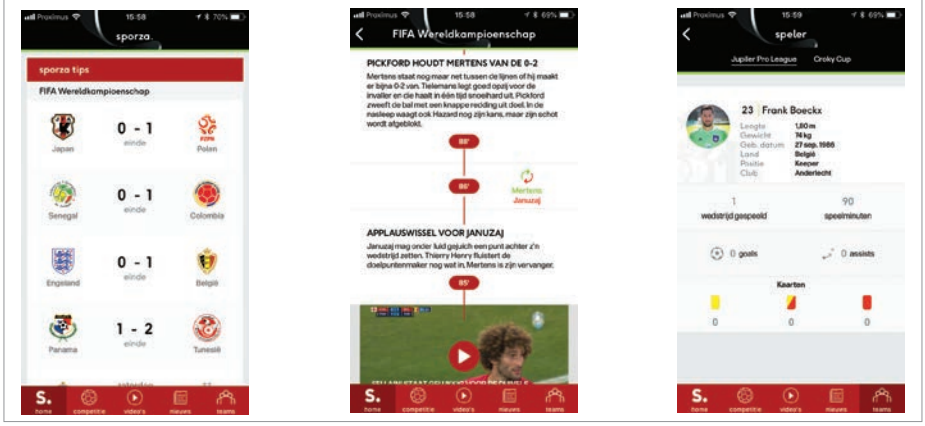
Since we introduced the fully-fledged UX approach, we've noticed that accessibility is being considered much earlier in the product process. Personas of people with disabilities and elderly people are introduced on whiteboards, and developers have started developing with a solutions-driven mindset rather than a checklist-based approach.

INCLUSIVE DESIGN

We have also introduced inclusive user involvement at all stages of the design and development process. We invite people with and without disabilities, elderly people and those whose mother tongue isn't Dutch to jointly participate in sessions where we discuss concepts, designs and functionalities for new or existing digital products and to perform in-depth user tests.

Bringing together a varied group of participants with a representative age distribution has generated some notable advantages. Mutual respect for each other's needs has increased: participants with a disability clearly indicate what is essential to them. But at the same time, they better understand that we may not be able to implement their entire wish list. Other participants also better understand the choices we make to address users' special needs. Overall, we have reached a broader consensus across different target groups.

VRT's Sporza app was developed hand-in-hand with a broad cross section of users.



EXAMPLE: SPORZA APP

The Sporza football app demonstrates the results of our inclusive approach. It's a complex product that makes extensive use of tables, live feeds, icons and abbreviations. Our challenges included:

- providing tabular data (match results, league standings) in an understandable manner, both visually and audibly;
- offering the best possible UX when consulting live feeds, both visually and audibly;
- presenting alternatives for icons and expansions for abbreviations.

At first the tabular data in the app was not sufficiently clear to screen reader users. For example, a match result was visually presented as follows:
Team name • (Live) score • Team name

But screen reader users preferred to hear this:
Team name • Team name • (Live) score

We decided to slightly alter the regular linear reading order. We did this in close collaboration with people who have difficulties with reading on screen and use, by way of support, simultaneous audio output, because we didn't want to negatively impact their user experience.

We managed to reconcile what is visually very recognizable and familiar to football fans with an understandable reading order for screen reader users who want to follow their favourite teams or competitions. Moreover, we also attached clear labels to each icon and provided expansions for all abbreviations.

For our developers this was a feasible effort but for our end users it has had a big impact. A highly accessible video player will soon be available in the app, as well as improved live feeds. It all comes back to that core goal: to achieve a fully-fledged user experience.

Building blocks for radio's future

THE EBU'S **BEN POOR** TALKS ABOUT THE NEW OPEN.RADIO INITIATIVE, WHICH AIMS TO HELP EBU MEMBERS AND OTHERS CREATE SOME OF THE BUILDING BLOCKS FOR RADIO'S FUTURE.

I've written before in these pages about aspects of the future of radio: new user experiences, new platforms, new opportunities for audience personalization. While evidence shows that broadcast platforms are still vital for radio (see issue 31), more and more public service media organizations are preparing for a growing share of IP-based listening.

Despite some marked differences in opinion on when (and if) an all-IP future for radio will happen, it is undeniable that IP is a valuable complement to broadcast for current audiences. Using broadcast and broadband together in Hybrid Radio enables a new user experience for radio across a range of devices: in-home, in-car and mobile.

But if we want to construct innovative new functionality with Hybrid Radio, what are our building blocks?

MADE WITH METADATA

In our modern and connected world, the key is metadata. In digital radio, the audio content is carried as data (e.g. using DAB+ or an IP stream), but this gives us a limited amount of additional information. If we want to have extra layers on top of this audio content, then we need metadata. This is literally "data about data" and provides greater context around the audio.

This additional contextual information supplies the building blocks for our new user experiences and services: everything from enabling a richer in-car display with images and information on the current song, descriptions and locations of on-demand content linked to the current programme, to methods of interacting with and personalizing a radio service.

The blocks fit together like LEGO®, with which we build things either by following instructions or using our own imagination. But with our radio building blocks this is only possible and repeatable when we are sure that the blocks will fit together: we need to define and implement standards. These standards detail the basic shapes of the blocks: their dimensions, how they will connect. For our blocks to be useful, we need them to follow these standards.

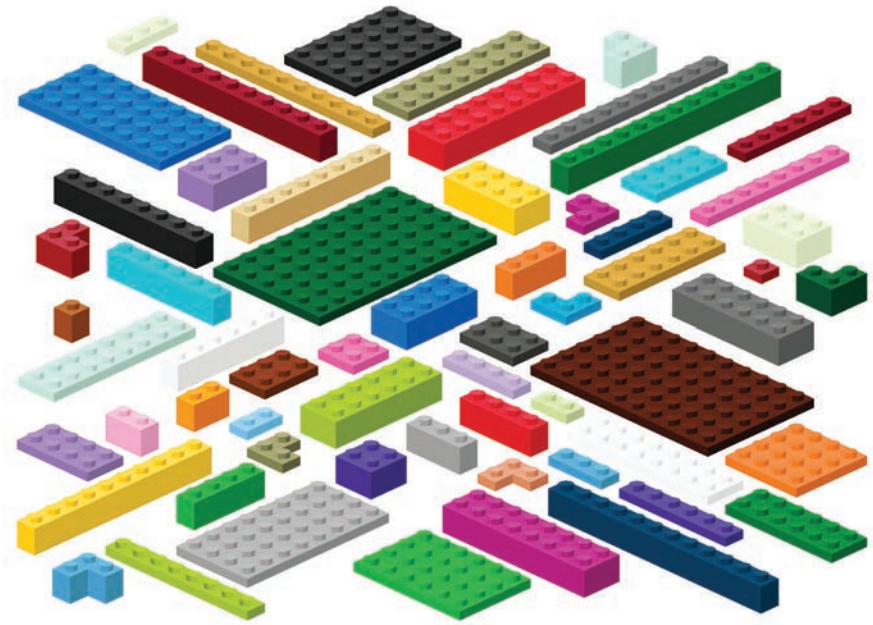
If standards are good for one brand of building blocks, what about the others? As a consumer, I'd rather they were all compatible, regardless of the manufacturer. This means that I won't need to worry about whether different brands will fit together. If I'm in a shop, I only want to pick the models that appeal to me most.

THE OPEN.RADIO CONCEPT

By defining standards for radio metadata, we create an environment where content can reach further onto new platforms and be more engaging to audiences. By coming together and agreeing on open standards, we ensure this is interoperable and new user experiences are available wherever our audiences are. If we accept fragmentation of standards then we risk limiting what we can achieve as an industry. If we accept proprietary models, then we risk gatekeeper issues.

But it's not just about standards, we also need implementation. The EBU will shortly be launching its open.radio initiative, to further promote the use of open standards for radio, as well as provide tools for broadcasters to use. One initial milestone is for the EBU's own metadata platform to be released as an open source project. This will be an easy-to-install and use service, and will drive greater support for and engagement in these standards. Future milestones cover additional layers of services for visuals, discoverability and interactivity.

To learn more about the project, go to http://open.radio, or contact Marcello Lombardo (lombardo@ebu.ch) or Ben Poor (poor@ebu.ch).



By defining standards for our radio building blocks we can enable a rich and diverse range of services.

Step into the cloud

OSCAR TERAN, HEAD OF TECHNOLOGY & SOLUTIONS AT EUROVISION MEDIA SERVICES, EXPLAINS HOW A SHIFT TO DISTRIBUTED, CLOUD-BASED ARCHITECTURES IS OPENING THE DOOR TO NEW WAYS OF WORKING, BOTH IN-HOUSE AND AT EUROVISION'S MANY CLIENTS.

Oscar Teran, Head of Technology & Solutions at Eurovision Media Services

The Eurovision Global Network delivers more than 100,000 transmissions every year, carrying thousands of hours of major sports, news and cultural events. In the same way that media organizations have begun the transition to IP-based production and workflows within their own facilities, we at Eurovision Media Services have been working hard over the last few years to stay ahead of the game and provide technology solutions that help clients to maximize their reach to audiences around the world.

VIRTUALIZATION

Our vision is to build the network of the future. To do so, we continue to enhance our Eurovision Global Network by putting in place the tools needed to allow us to deliver premium services in an enterprise-quality cloud. We recently upgraded the Eurovision Global Fibre Network with optical IP fibre that is highly programmable with end-to-end QoS and delivers multiple 100 gigabit per second flows. We also introduced new software-based processing units that are able to adapt their functions to client demands thanks to virtualization. Gradually we're adding more possibilities for clients to plug-in their own production resources and programme their own distributed workflows.

What we see today is networked IT and reprogrammable real-time architecture coming together in the cloud, offering full orchestration within the entire media production and delivery chain. Gradually, our satellite infrastructure will converge with this approach.

In Eurovision Media Services we are increasingly taking advantage of the private cloud-based world: real-time, high bandwidth, uncompressed. We also combine it with deployments in the public cloud for specific applications. As we are providing a wide range of media services, it is our priority to make the new infrastructure operate services end-to-end, from broadcast delivery to streaming.

A key element for us is to make it possible to quickly and easily programme workflows through the front end, embedding them into the cloud. Our starting point is a professional network with high reliability, where clients can orchestrate microservices in real time. We're working to ensure a certain amount of standardization in the real-time programming unit so that we can change functionality quickly, adapting to the production needs of our clients.

DEVOPS TEAMS

The challenges are both technological and human, to ensure the necessary agility and flexibility. We are constantly training our staff and sourcing new talent with the necessary skills to take advantage of the new IT tools. For example, while routing becomes more and more a commodity task, there is a need for a network centre that monitors the global cloud on a permanent basis. And even with a high degree of programmability and automation, there's still a need to be available to clients that require specific workflows other than those available off the shelf. The DevOps teams delivering these services are also responsible for the support and development of the system's back and front ends for each business application.

So, we're seeing a gradual change in both the talent and the working methods in-house. Our teams increasingly come from the IT industry, bringing expertise on the software and orchestration framework to deliver microservices. But it is also essential for them to have a strong understanding of the broadcast world. Broadcast-IT talent and the focus on talent development are key in this new world.

We're on a dynamic and exciting journey. We've already rolled out a first example of our distributed cloud approach with some of our big clients, introducing the idea of re-programmability in both linear and non-linear services. We're striving to foster a culture of innovation within our organization, underpinning the development of these new products and services.

"We've already rolled out a first example of our distributed cloud approach with some of our big clients, introducing the idea of re-programmability in both linear and non-linear services."

The value of intelligence

THE EBU'S MEDIA INTELLIGENCE SERVICE (MIS) OFFERS MEMBERS EXCLUSIVE ACCESS TO VALUABLE REPORTS AND ANALYSIS. MANAGER OF MIS **DAVID FERNÁNDEZ QUIJADA** OUTLINES CURRENT AND FUTURE RESEARCH TOPICS.

The EBU's Media Intelligence Service was established in 2012 to conduct market research. It provides value to Members in two different ways: directly through the data, trends and analysis included in our reports, and indirectly through the support we provide to the activities of our colleagues in other departments, including Technology & Innovation (T&I). Our work spans three main areas: public service media (PSM), audiences and market insights.

PSM DATABASE

In the field of PSM, we manage probably the most comprehensive database about public broadcasters in Europe. This is the result of systematic data collection across years, consistent quality control, and evaluation of the indicators collected and potential new ones. Especially relevant for the technical community is our annual data collection for online developments, which includes a definition process with our colleagues from T&I. Thanks to their expertise in the different topics covered and our expertise in the market and methodology, we are constantly improving our questionnaire targeted at EBU Members. They provide their own data, which feeds back into the database. Results related to apps, virtual and augmented reality, personalization, metadata or online analytics are already available to you on our website, and more besides.

The field of audiences is one of the most relevant for colleagues working in technology. We work to understand consumption trends and audience behaviour amid the growing popularity of on-demand viewing and listening, the development of personalized services and increasing interaction with new value propositions. All these trends are not just powered by the possibilities of technology; they simultaneously inform future innovations. Take a look at our annual Radio, TV and Media Consumption Trends reports to read about such topics in greater depth.

Our third area of research covers market developments. This broad field includes the implementation of technologies in different markets and the disruption of new players. Examples of our work can be found in our annually updated data on equipment penetration in Europe and all our radio-related projects, such as the annual Digital Radio report, the recent audio-on-demand report or last year's analysis of Radio Distribution Networks.

INSIGHTS ON DEMAND

What more can you expect from us? Recently we have been working on topics with a high technical focus. This includes sign-in to online services offered by public broadcasters, development of the market for voice-controlled devices and scenarios for the media market in the medium term, to name a few. Although some of those projects are not covered in a specific report, we can usually share our data and insights with EBU Members – just contact us if you are interested.

Please do not hesitate to send us your requests. Our service is available to all EBU Members via mis@ebu.ch. Whatever the figure, information or trend, we will look for it and deliver what is available. **See: www.ebu.ch/mis.**

Media development in the Land of the Giants

WHERE, WHEN AND HOW SHOULD A MEDIA ORGANIZATION USE ITS LIMITED RESOURCES IN THE MOST COST-EFFECTIVE WAY? **DAVID WOOD** ASKS WHETHER WE'RE DOING THE RIGHT THINGS, IN THE RIGHT WAY AT THE RIGHT TIME.

"If we want to have an impact on our world, we need to be at the leading edge of media technology development. Alas, the problem is not the idea, but how to do it."

We've all heard it: outsiders look from afar and say: "Are you sure you're taking into account this or that important new development?" We all know the list of hot subjects: the cloud, AI, extended realities, 5G, 8K, and more. But in our new land of media giants, there is no certainty on exactly how best to spend a media organization's resources in new technology.

SHIPBUILDING

If broadcasting is a ship, its hull – the structure on which it floats – is technology, so we can agree that technology development has to be a part of a media company's thinking and spending. Marshal McLuhan, one of the last century's most acclaimed social scientists, coined the phrase "the medium is the message". He meant that it is media technology that changes society rather than the content that it carries, an example of the theory known by academics as technological determinism.

The last few decades have proved McLuhan correct. For example, it is internet technology rather than any specific website that is creating the world we live in. Our conclusion can be that if we, public service media, want to have an impact on our world, we need to be at the leading edge of media technology development. Alas, the problem is not the idea, but how to do it.

If we could wind the clock back to the last century, we would find the EBU and its Members at the very centre of new media technology developments. Many Members had research and development labs. As they were not competing with each other, they could all work together. The EBU Technical Department itself was also by no means small. This led to the successful development of systems for satellite broadcasting, digital television production and digital radio production, now used around the world.

How much did this cost? At the peak of size and success, the Members who had R&D facilities were investing about 1% or less of their income in them.

KEEPING UP WITH GIANTS

Today we are on a very different planet. Fewer Members have R&D facilities, and the EBU Technology & Innovation department is smaller. At the same time, we have seen enormous growth in media R&D in the USA, Japan, China and Korea. Companies there are spending 10% and more of their revenue on media R&D. This amounts to literally billions of dollars per year.

The companies concerned with hardware and commercial software, like Samsung, Apple and Microsoft are certainly spending a lot on R&D, but the biggest spenders are the companies that provide services and content, like Google, Facebook and Amazon. To a degree these are organizations competing for the same audiences as traditional broadcasters. They are in the same game.

But, for all that, the EBU and its Members have had, and continue to have, certain successes in technology, even in the Land of the Giants. Though smaller in absolute terms, the *proportion* of R&D activities that produce useful results is bigger. The recent development of the key missing production element for next generation audio (the EBU ADM Renderer), PEACH and the EBU metadata specifications are just a few examples of small, but high impact successes.

Is this because we have been lucky or because we have been astute? I like to think it's the latter.

The importance of putting HbbTV to the test

THIS UPDATE FROM THE HBBTV ASSOCIATION CONTINUES OUR SERIES OF ARTICLES FROM OUR PARTNER ORGANIZATIONS IN THE TECHNOLOGY DOMAIN. **JON PIESING** (TP VISION) IS VICE-CHAIR OF HBBTV'S STEERING GROUP.

HbbTV, standing for Hybrid Broadcast Broadband TV, is a global initiative aimed at harmonizing the broadcast and broadband delivery of entertainment services to consumers through connected TVs, set-top boxes and multi-screen devices. We have more than 70 members from around the world.

DIFFERENT APPROACH

In common with many similar organizations, our work is driven by market requirements. Once these are finalized, technical specifications are developed by the interested members organized in various working groups. Where we differ from some organizations is that we do not publish specifications until corresponding unit test descriptions have been written and reviewed (so-called "assertions"). While this may seem a hard target, experience shows that it enables a smooth progression from specification development to test development – something that did not happen otherwise.

Looking ahead, one priority for the association is to continue the investment in developing and reviewing more unit tests to be integrated into the HbbTV device test suite. These will cover a remaining part of the 2.0.1 specification, the Operator Application specification, HDR and HFR video, and Next Generation Audio, the latter being part of the recently released 2.0.2. Although these test suites are for devices, they benefit broadcasters and application developers by reducing the time spent testing and debugging apps on different TV sets and set-top boxes. Some

Jon Piesing

of the new unit tests will be approved in time for products entering the market in 2019, whose development is already well advanced.

HbbTV is also investing in other ways to reduce the time spent testing and developing apps. We have commissioned a reference app and supporting content for HbbTV, DASH and DRM (digital rights management). We are paying for this to be tested on a sample of the HbbTV TVs from the major brands present in the market since 2014. This known working app and content will provide a working example that developers can follow for the use of DRM with DASH in an HbbTV context. Another way HbbTV is investing in this area is extending the DASH-IF content validator to support validating content for compatibility with the HbbTV and DVB profiles of MPEG-DASH.

COMMERCIAL ADVANTAGES

A second priority in the coming year is a new communication and promotion strategy – recognizing a renewed need for marketing, lobbying and networking on HbbTV technology. The new strategy is based on a more businesses-oriented communication towards potential HbbTV adopters, broadcasters and operators first and foremost, offering them useful tools to consider commercial advantages of our technology. The proposition to serve our members and the whole industry from a business point of view will see a renewed plan of actions leveraging all the communication means that we normally use – the website (hbbtv.org), the social networks, the major industry events, our yearly symposium, our newsletters – with a message that varies according to the audience.

Other areas of activity for the association in the coming year include looking at the impact of GDPR and ePrivacy on the HbbTV ecosystem and planning for the next significant evolution of the HbbTV specification, whenever that is.

HbbTV services are deployed on various markets and new ones are continuously announced – one for all is LOVEStv, a joint FTA 7-day catch-up service created by Spanish broadcasters RTVE, Atresmedia and Mediaset – and the association aims to leverage these kinds of experience, and the related best practices, to share them within our community.

We continue to support our members and the industry; our new strategy will allow the HbbTV Association to remain a lively organization to drive business creativity and commercial advantages based on our compelling technology.

Making cybersecurity a priority for media

A SERIES OF EBU RECOMMENDATIONS HELPS MEMBERS TO BETTER UNDERSTAND THE THREATS ASSOCIATED WITH MEDIA CYBERSECURITY AND EQUIPS THEM WITH TOOLS TO ADDRESS THOSE THREATS. **ADI KOUADIO** PROVIDES THIS OVERVIEW.

The EBU's strategic programme on Media Cybersecurity was launched in 2014. We knew from the outset that the road to helping Members achieve even the minimum acceptable level of security would be a long one, especially with the legacy conservative culture of broadcast media. We have made considerable progress along that road, with a suite of recommendations supported by hands-on tools and tests. But first, let's look at where and why security concerns arise for media companies.

DISRUPTIVE WAVES

The media industry is being heavily disrupted by a succession of digital technology waves. From cloud technologies, with their promise of more flexible use of resources, to AI, and social media platforms, which are disrupting newsrooms and journalism. Incumbent media companies are in survival mode, trying to identify the best synergies between these technologies to remain relevant. And with content personalization a dominant trend, data breaches and new regulations such GDPR require media companies to implement measures to secure personal data.

However, we have seen that in media, security is marginalized until it is too late. In a desperate attempt to adopt all these technologies at once, most companies fail to also adopt the accompanying security policies and best practices that are commonplace in the IT world. In some cases the practices may not fit well with media workflows, but in others it's more a case of the broadcast world failing to understand or even consider them.

Even leaving aside the influx of disruptive technologies, existing media devices are already networked to a certain extent, for management and control. Unfortunately, such connected media devices tend to have a low security threshold, inherited from the era of non-connected broadcast media, where cybersecurity due diligence was usually far from a top priority for either manufacturers or users.

HOW THE EBU HELPS

The EBU Technical Committee's strategic programme on Media Cybersecurity (MCS) has as its goal to "make security a minimum quality requirement for media content, services, and systems". To fulfil this goal, the programme's activities are organized along three axes:

1 *Awareness of security as a business risk*.
By raising awareness among media personnel – and in particular senior staff – we can ensure that there is sufficient support for appropriate processes and policies. Information security officers at media companies (if they have one) often have only a limited direct reporting line to the top management. They have difficulties obtaining sufficient support or attention for their concerns, unless the damage is already done or ongoing. For media companies, the brand damage and financial loss of a successful attack can be significant (e.g. notable cases at TV5, Sony, etc.). Support from the highest levels is important to enforce security measures. EBU R 144 provides guidance to senior management on best practices for governance, including the organizational structure necessary to meet the minimum-security benchmark.

2 *Ensure security by design*.
Not only should executives support security due diligence but security should be considered by design in every process, project and service in alignment with the media workflows and business objectives. To be effective, all parties of the media ecosystem must be involved in the effort. The MCS programme has created a set of guidelines to address both system manufacturers (R 143, cybersecurity for media vendor

NETWORK & LEARN

Our quarterly online webinars address key topics of concern (Security Operations Centre implantation, secure file ingest, etc.). Find information about past and future webinars at tech.ebu.ch/events

The annual **EBU Media Cybersecurity Seminar** has become *the* rendezvous for media security professionals, addressing topics from content and infrastructure security to disruptive technologies (AI, Blockchain, etc.) and regulations (GDPR, etc.). Join us for valuable insights and informative talks: 16-17 October 2018, EBU, Geneva.

systems, software & services) and cloud service vendors (R 146, cloud security for media companies). R 143 can be included as an appendix to an RfP or RfI to determine the level of security due diligence performed by the vendors. Fostering global adoption, the World Broadcasting Unions and several broadcast organizations (NABA, EBU, and ABU) have adopted a unified security recommendation, based on R 143, to be endorsed by all system vendors.

3 *Implement security hands-on*. Having policies is a good start but knowing how to verify them and run self-checks on compliance is better. MCS provides Security Hands-on tools and tests for media operational staff to investigate and proactively detect potential vulnerabilities in purchased or installed media equipment (R 148, minimum security tests for networked media equipment). These tests can be performed by system vendors and/or broadcasters. Typical threat mitigation scenarios are also available for the most popular threats to media services (DDoS, ransomware). In the context of journalists and operational staff going abroad, a practical guide to security measures for before, during and after a field operation (EBU R 150) is scheduled for publication in September 2018.

We're confident that this three-pronged approach – focusing on awareness, design and testing – will help EBU Members and the wider industry to come closer to the level of the IT industry in terms of security best practices.

IN THE SPOTLIGHT

Michael Eberhard

SWR, GERMANY

WHAT ARE YOUR CURRENT RESPONSIBILITIES AT SWR?
I'm the Managing Director of Technology and Production at Südwestrundfunk (SWR), with my responsibilities spanning TV, radio and online production. This includes, for example, editing suites, control rooms, studio and IT infrastructure, and all related workflows and staff.

WHAT DO YOU CONSIDER AS YOUR FINEST ACHIEVEMENT SO FAR IN YOUR CAREER?
I was head of the project for the new broadcast building in Stuttgart, which includes three TV studios and production suites and the facilities for two of our radio channels. Aside from that, the complete reorganization of our technology and production management along with the production workflows was one of my biggest career achievements.

WHAT ARE YOUR PREDICTIONS FOR MEDIA TECHNOLOGY IN THE FUTURE?
Boundaries between media are disappearing more and more and media technology is developing faster and faster. I think that media technology will be increasingly important in all aspects of our daily business and workflows in the future. The use of new technologies like IP or 5G will influence our processes significantly. New standards and mindsets, as well as continuous adaptation, will be essential to face upcoming challenges in the broadcast business and to increase efficiency throughout our work.

WHAT, FOR YOU, ARE THE MOST IMPORTANT CHALLENGES FACING EBU MEMBERS TODAY?
The biggest challenges for EBU Members will be the decline of financial resources and the fast development of technology. The combination of both will be a huge challenge, but also a big opportunity for us.

TELL US ABOUT SOME OF YOUR INTERESTS AWAY FROM THE WORKPLACE.
Before I started my career in sound engineering, I studied saxophone and piano. Music is still one of my biggest interests and also a balance to my daily work.

Media Cybersecurity Seminar 2018

Geneva, 16-17 October

tech.ebu.ch/mcs2018

- **Cybersecurity for infrastructure, services and events**
- **Content security & anti-piracy**
- **GDPR**
- **Disruptive technologies in cybersecurity**

FORECAST 2018

Geneva, 19-21 November

tech.ebu.ch/Forecast2018

Will the future of broadcasting be decided in 3GPP?

- **5G for broadcasters: what is it, what will it be, and when?**
- **Enhancing linear broadcasting**
- **Optimizing network planning**
- **Standardizing linear TV over broadband**
- **Challenges for broadcasters in OTT**
- **Real spectrum requirements for mobile services**

Production Technology Seminar 2019

Geneva, 29-31 January

tech.ebu.ch/pts2019

- **Data and AI in media creation**
- **New workflows and tools**
- **Innovation strategies**
- **UHD, HDR and HFR in operation**
- **Advanced audio**

... and much more.

For our complete lineup of conferences and workshops, including focused events on topics such as **Artificial Intelligence (Geneva, 8-9 November)**, visit tech.ebu.ch/events