

tech-i



Got their MoJo working

Plus

**HEVC & HIGH FRAME RATES
STREAMING OUTSOURCED
FIMS MOVING FORWARD
FREE COOLING AT RTP
*and more...***

Issue 19 • March 2014

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Cover Story: A photo of Patricia O'Callaghan, one of RTÉ's online journalists. Among EBU Members the Irish broadcaster has been one of the pioneers of Mobile Journalism. Turn to page 8 for the full story.

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Uncompromising innovation

Simon Fell, EBU Director of Technology & Innovation

– immersive experience will change the game.

On the audio side of things, multi-channel audio is the subject of many experiments but a solution that provides a sensible rig for the living room seems still to be elusive.

Interestingly interactive television is getting a new lease of life in Japan with the emergence of hybrid-cast services that began broadcasting last year. The system uses HTML5 and achieves excellent integration with second screen devices on the home network. The graphics quality in HD and smoothness of the rendering was most impressive. Ideas that we've seen in Europe, news tickers and voting on game shows, are finding new energy on the Japanese market. The use of a trigger pulse to synchronize games with second screen apps also brings benefits in terms of usability and functionality for the viewer.

So on the whole a very encouraging visit, where a different take on technology and development shows a refreshing *no compromise* approach to the future of television. I don't expect the spectrum to be available for the replication of such experiments in Europe in the present circumstances but our Japanese colleagues show what can be achieved with a forward-looking vision.

I hope you enjoy this issue of tech-i. There are some very interesting articles from across the range of our members. I'm particularly drawn to our cover story on Mobile Journalism at RTÉ, where the power of mobile devices in production is brought to life. I was struck (not literally) on a recent skiing holiday that about 10% of the skiers wore a helmet-cam as they careered down the mountain. I suspect many of these are 4k already, showing that the public yet again is grasping the new technology at a rate that should make all producers draw breath. How about a user-generated Winter Olympics? Actually I think I will continue to enjoy the great HDTV images from the event while looking forward to a 4k or even potentially 8k Winter Olympics to come.

Innovation has a way of surprising us. Before we look to the next ten years we can look back over the last ten years and see all of the inventions that have become commonplace. Does this mean the pace of invention will slow down? I think not. On a recent visit to Japan with the EBU Technical Committee I found it encouraging seeing that innovation is still uppermost for Japanese technology companies.

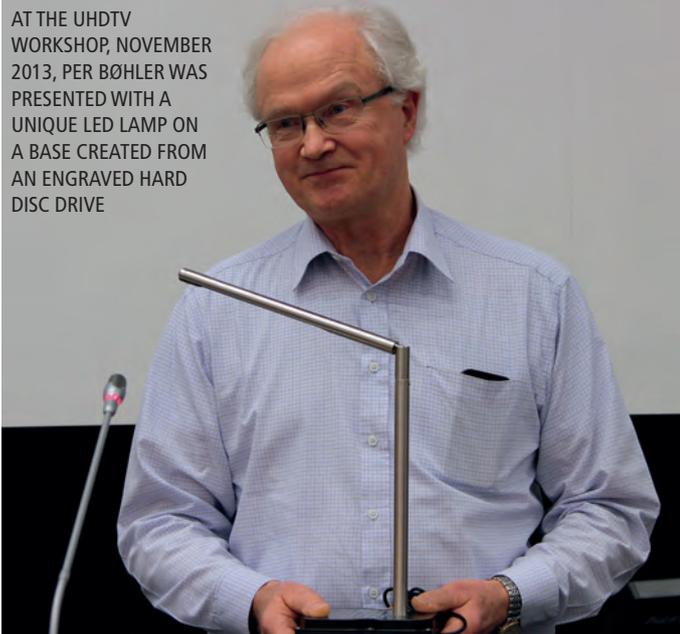
Indeed, while we were there the national broadcaster NHK announced their first successful long distance test transmission of 8k (or Super Hi-Vision) transmitted terrestrially over a distance of 27km in a single 6 MHz UHF channel. The picture resolution was 7680x4320 pixels and the transmission used dual-polarized MIMO multiple antennas and ultra-multilevel OFDM, with 4096 QAM, delivering a bit rate of 91.8 Mbps using MPEG-4 AVC/H264. (*Editor: that's enough acronyms!*)

Their ambition doesn't stop there: they're planning 8k transmissions for the 2020 Olympic Games and are experimenting with high frame rate content at 120 frames per second. So it's full speed ahead for the Japanese on 8k, while elsewhere the talk is of distributing 4k UHD TV over IP infrastructure. It gives us plenty to think about. Some European broadcasters caught in these constrained financial times may view this as too much, but others might be inspired to think big for the future.

The emergence of UHD TV will bring changes to production techniques. I've seen examples where multiple HDTV images are either stitched together for a wide overview shot of the whole scene, or shown in a mosaic or multi-view layout that allows the viewer to absorb different aspects of the action. The creative potential of this new medium is immense, and producers who grasp this and provide a compelling – but not overwhelming

RETIREMENT

AT THE UHDTV WORKSHOP, NOVEMBER 2013, PER BØHLER WAS PRESENTED WITH A UNIQUE LED LAMP ON A BASE CREATED FROM AN ENGRAVED HARD DISC DRIVE



PRESTIGIOUS AWARD FOR KEY PUBLIC SERVICE MEDIA TECHNOLOGY LEADER

Per Bøhler recently received the Norwegian King's Medal of Merit, marking his retirement from NRK and his many achievements as an outstanding contributor to the worldwide media industry, writes the *Hans Hoffmann (EBU)*. Per has been involved in the technical activities of the EBU for many decades, spanning a range of roles and functions. He has been proactive in shaping and driving technological developments in the field of programme production, a fact that we were pleased to acknowledge in front of his peers at our UHDTV workshop last November.

Per was a key figure in driving the digitalization of production infrastructures in the nineties and contributed to many EBU and ITU-R outputs that were required to achieve interoperability for digital television. He was behind the development of several best practice documents, recommendations and industry statements that helped EBU Members in their migration to digital technologies. He later also became the chairman of the EBU's Production Technology Committee, a role that required him to solve many difficult "techno-political" problems involving the international industry, to ensure that the requirements of EBU Members would be implemented in new products for HDTV.

On top of his leadership roles in EBU committees, his knowhow on video and compression technology, cameras, optics and related matters have meant he is in high demand on the international conference circuit. He has a rare ability to explain complex technical matters to everyone from experts to non-technical management. He is a top class educator and trainer.

Most recently in the EBU he chaired the Future Television Production strategic programme, under which fundamental work on the impact of LED studio lighting and camera measurements, new studio compression, new studio infrastructures and early work on UHDTV was conducted. This work has also been recognized in Hollywood, where among camera and lighting experts Per is noted as a leader on broadcast technologies.

Per Bøhler has left his footprints on the history of the technical activities of the EBU, as an excellent innovative engineer, as a leader of committees and as a partner of EBU Members and the international broadcasting industries. We wish him a long and healthy retirement but also hope he will not entirely stop contributing his expertise.

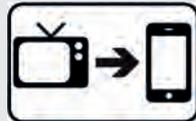


BroadThinking 2014

26-27 MARCH, GENEVA

The event where Broadcast meets Broadband, it will be of interest to anyone working with hybrid services, interactivity, second screen, CDNs, IP delivery and everything related to providing media on the internet.

<http://tech.ebu.ch/broadthinking2014>



Integrating Broadcast Receivers In Handheld Devices

28 MARCH, GENEVA

A workshop to identify the main drivers and roadblocks for the inclusion of broadcast receivers in handheld devices.

<http://tech.ebu.ch/ctnworkshop14>



Metadata Developer Network Workshop

3-4 JUNE, GENEVA

This workshop is a unique chance to be updated on the use of metadata in the broadcast industry and to learn by joining the discussions.

<http://tech.ebu.ch/mdn2014>



EBU Technical Assembly

12-13 JUNE, PRAGUE

This year's TA takes place in Prague, hosted by Czech Television. All Technical Directors and Chief Technology Officers of EBU Members are encouraged to attend.

<http://tech.ebu.ch/ta2014>



Network Technology Seminar 2014

24-25 JUNE, GENEVA

The Media and IT Rendezvous. Bringing together specialists in broadcast engineering and IT networks and infrastructure, whether for production, contribution, B2B, or primary distribution.

<http://tech.ebu.ch/nts2014>



IBC 2014

12-16 SEPTEMBER, AMSTERDAM

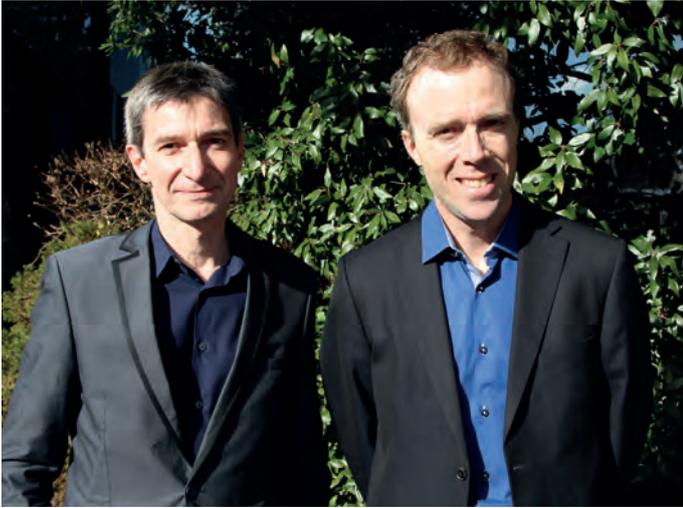
As usual the EBU will be present at Europe's premier broadcast media convention. Our stand will showcase a number of technology demos with half-hourly presentations on a range of topics.

<http://tech.ebu.ch/ibc2014>

The presentations given at all EBU Technology & Innovation events are available from our website, often with accompanying videos. Just visit our Event Calendar and click on Past Events. <http://tech.ebu.ch/events>

PRODUCTION TECHNOLOGY SEMINAR 2014

YES TO DIALOGUE, NO TO “VERSIONITIS”



One hundred and thirty participants, twenty-four presentations, seven tutorials, five technology demonstrations, one interactive discussion panel and countless conversations, exchanges, questions and remarks: for two and half days in January the EBU was a veritable hive of activity during the annual Production Technology Seminar. And the feedback received since the event suggests that it was considered one of the best ever.

A dominant theme to emerge this year was the growing need for dialogue between creative and editorial staff at broadcasters and those responsible for the technology. Contributions from the BBC's Mark Harrison (speaking on behalf of the Digital Production

Partnership), digital strategist Kevin Andersen and executive producer Bill Scanlon all highlighted this issue. In an age where technology opens up all kinds of new possibilities the challenge is to put in place solutions that meet the needs of the people using the tools.

One of the keynote presentations came from Netflix, an increasingly influential player in the media world. Kevin McEntee, who's responsible for the digital supply chain at the streaming giant, said that the arrival of UHD TV presents a standardization opportunity that the industry, including broadcasters, should grasp. In their relatively short lifetime the television and film industries have given birth to a fragmented and sometimes frustrating variety of standards and formats, leading to the growth of what he termed “versionitis”. He said that, in agreeing on a UHD TV standard for the future, the industry should not allow itself to be bound by the legacy of the past.

The range of topics discussed at PTS 2014 was wider than ever. The presentation sessions included updates on video compression, workflows and integration, new audio technologies, metadata management, UHD TV parameters, and production infrastructures. The tutorial programme was expanded further this year, allowing participants to choose two from a line-up of seven different sessions.

In parallel with PTS the BeyondHD group also held eleven viewing sessions, each with five participants. The sessions were designed to help develop a test methodology for image dynamic range. Some preliminary findings were announced during PTS, confirming for example that the benefits of higher dynamic range are perceptible also from distance (in contrast with higher resolution).

But the longer term impact of the viewing sessions will be in contributing to the development of formal subjective testing later this year.

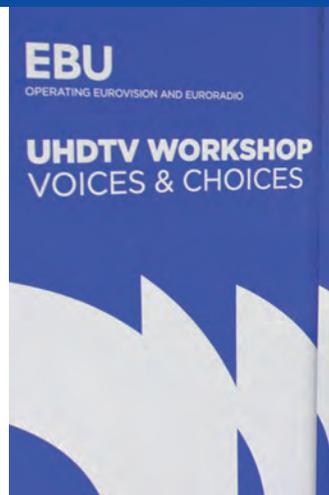
UHD TV: VOICES & CHOICES

BEWARE OF A “POOR MAN’S UHD TV”

It was just a throwaway remark from a delegate at November's UHD TV: VOICES & CHOICES workshop, but it seemed to strike a chord with delegates, writes Yvonne Thomas (EBU). The proposed first phase of UHD TV was described as being akin to a “poor man's UHD TV”, echoing the feeling of many that the real benefits of the new format would come only with key additional features in later phases.

More than 120 delegates attended the workshop at the EBU, with representatives of broadcasters and the wider industry intensely focused on the future of Ultra High Definition TV. Discussions ranged widely across the technical challenges, the parameters to be chosen, the “wow” factor, the timescales involved, and of course the applications and business models for future UHD systems.

While the main focus was on interactive discussion, a set of interesting presentations put everything in context. There were, for example, talks on the human visual system and video coding, plus insights from the various national (U)HD TV forums. Breakout groups were formed to address in detail the topics of UHD studio infrastructure,



distribution, transmission and the audio chain.

All four groups concluded that UHD TV Phase 1 was almost defined and agreed that the time was right to start defining Phase 2. This latter phase should include HDR (higher dynamic range), HFR (higher frame rates), BT.2020 colour space, higher resolution and, not least, an advanced audio system. The topic of an enhanced HD service, that would include a combination of UHD TV parameters, also came up for discussion.

There was a clear preference towards “better pixels”, as opposed to just more

pixels, to provide a more realistic viewing experience. The biggest challenge would be to define a complete UHD TV chain from glass-to-glass. Thus, Phase 1 will be a format only for the early adopters: mainly private broadcasters and service providers. EBU Members – the public broadcasters – will remain focused on Phase 2 or perhaps the enhanced HD service with the 2020 Olympic Games in mind.

The workshop was a great success and thanks are due to all participants, speakers and demo providers. A follow-up workshop is scheduled for May 2014. For details contact Yvonne Thomas (thomas@ebu.ch).



SUCCESSFUL FIRST OUTING FOR A NEW ACTIVITY

The trial in January of a new kind of EBU activity was triggered by a request from the Technical Committee, writes *Félix Poulin (EBU)*. The TC asked the Strategic Programme on Future Networks and Storage Systems (SP-FNS) to prioritize the hot topic of Networked Production, i.e. the eventual replacement in the live production studio of speciality broadcast interfaces (SDI, AES, etc.) by packet networks (IP, Ethernet, etc.) using generic IT equipment (switches, servers, routers, etc.).

The idea of μWorkshops (pronounced micro-workshops) came from a discussion in SP-FNS (chaired by IRT's Markus Berg) on how we could best help the Members in this area. A specific challenge: proprietary solutions are emerging quickly from manufacturers, with a risk of reduced interoperability and vendor lock-in. Also, broadcasters are on a steep learning curve with regard to the use of IT technologies for their most demanding and critical application, live production.

The group identified that the most urgent need for broadcasters is to learn about these new technologies and share their early experiences. One of the EBU's proven strengths is in connecting its Members and facilitating knowledge-sharing, thus reducing duplication of effort.

FNS wanted to address this urgent need while operating with the

same resources – the creation of an additional project group was ruled out at this point. They came up with the idea of dedicating the first day of their quarterly face-to-face meetings to a specific topic, with Networked Remote Production chosen as the first target. The format was designed to be administratively and logistically lightweight.

The result – a first μWorkshop on 21 January at IRT, Munich – was well attended (23 participants, with many new faces) in an informal atmosphere with highly interactive, open and interesting discussions. Thematic discussions were interspersed with five presentations from experts and guest manufacturers. Participants raised the challenges they face in their respective organizations and possible new use cases enabled by these technologies. The debate on the best network solutions to use for these applications was sometimes passionate, but always respectful.

Based on the feedback received, FNS will build on this first successful experiment. Future topics have been identified and dates will be announced in due course. The format may be of interest to other EBU groups and could even stimulate better collaboration through the holding of joint μWorkshops on synergetic topics.

To join FNS and be informed about future μWorkshops: <http://tech.ebu.ch/FNS>

Join us at
DVB WORLD
 10-12 March 2014
 Prague

Full conference program and registration information at:
www.dvbworld.org

The quest for interoperability in networked production

THE IDEA OF USING IT INFRASTRUCTURE FOR BOTH LIVE AND FILE-BASED MEDIA PRODUCTION IS NOW FIRMLY ESTABLISHED. A SURVEY OF MEMBERS ONE YEAR AGO LED DIRECTLY TO THE EBU BEING ONE OF THE FOUNDERS OF A JOINT TASK FORCE ON NETWORKED MEDIA. NOW, WITH MANY SOLUTIONS APPEARING ON THE MARKET, BROADCASTERS HAVE THEIR USUAL REQUIREMENT: INTEROPERABILITY. THE EBU'S **FELIX POULIN**, AN ACTIVE CONTRIBUTOR TO THE WORK, TALKS ABOUT THE MOTIVATIONS BEHIND THE TASK FORCE, ITS FIRST RESULTS AND THE NEXT STEPS.

What is networked production? One simple way to explain it is that it replaces professional studio interfaces and equipment (like SDI, AES, MADI, Black Burst, serial control and crossbar routers) with generic IT infrastructure (commodity switches, servers file storage) and network protocols (like Ethernet and IP). This can result in reduced cabling and – yet to be proved – reduced costs based on the economies of scale that come with a market as big as the IT industry; broadcast equipment is a niche market in comparison.

But this oversimplified view misses the real reasons why broadcasters might want to move away from the open, widely adopted, simple, highly reliable, low latency world of SDI and the like. In fact, such standard interfaces are perfectly suited to today's live production environment.

WHY CHANGE?

Let's imagine for a moment how our industry will look, say, five to ten years from now, when this new technology generation will have matured. Put yourself in the shoes of the future media consumer: he will have access to exciting new formats (fully featured UHDTV, object audio/video, maybe holographic 3D, etc.); enriched and personalized content with timed and context-based metadata and visualizations (overlaid multiviews, virtual cameras, in-scene game-play, etc.); live interaction with the content creators (Twitter feedback, voting, etc.); and on a myriad of devices (watches, glasses, table-top, home appliances, etc.). It's the promise of the consumer electronics industry.

But to deliver this new content in a quickly and continuously changing landscape, the creators will need a lot of flexibility in work practices, new tools and new user interfaces, plus the possibility of working collaboratively and remotely. System builders, to supply

WHO RESPONDED TO THE REQUEST FOR TECHNOLOGY?

ALC NetworX GmbH - Avnu Alliance - Audio Engineering Society - Axon Digital Design - Barco NV - BBC R&D - Cisco Systems - Dolby Laboratories - EBU - EBU/AMWA FIMS Project - Ether 2 - Evertz - Harris Broadcast - intoPIX SA - L2tek - Macnica Americas - Media Links - Mellanox Technologies - Net Insight - Nevion Europe AS - Nine Tiles - OCA Alliance - Quantel Ltd - Scalable Video Systems GmbH - SDVI Corporation - Sony Corporation - Xilinx



the infrastructure that can support these new and adaptable workflows, will need modular resources that can be repurposed quickly, as soon as the demand pops up. Do those characteristics ring a bell? Flexibility? On-demand and distributed? Collaboration? That's where we turn to IT.

A NEW FORCE

The Task Force came into being when the Video Services Forum (VSF) invited many important players to a meeting in Atlanta in March 2013. It became clear that the attendees shared a common interest in product interoperability in a future networked media production environment. Also clear was that the goal could be best achieved if the whole industry worked together: users, vendors, integrators, network providers. And so the EBU/SMPTE/VSF Joint Task Force on

Networked Media was born.

There was no time to lose. Firstly, user requirements were collected in the form of user stories that, importantly, included a statement of the business value in each case. In June the 136 stories grouped into 17 categories were published. These in turn formed the basis of a Request for Technology published at IBC 2013. In all 27 respondents submitted a total of 66 technologies, existing or in development, which could fulfil part of the user requirements.

GAP ANALYSIS

The Gap Analysis Report published last December provides a summary of the responses, including links to the full submissions, some of which are very detailed. The intention was not to directly compare technologies. The significant number of responses indicates a high level of activity and interest, including from some key IT vendors. However, it's equally worth noting that some well-known traditional broadcast manufacturers were not on the list. Overall, the report provides a preview of the likely pieces of future networked media infrastructures.

The Gap Analysis raises many questions, not least the incompatibility of some of the proposed approaches. To achieve the goal of interoperability we need to understand how all these technologies can fit together in a system and locate the interface points where interoperability is required. Discussions about the next steps are ongoing between the Task Force partners and an announcement can be expected soon.

See: <http://tech.ebu.ch/jtnm>

HFR and video compression

HIGHER FRAME RATES (HFR) ARE WIDELY BELIEVED TO IMPROVE THE PORTRAYAL OF MOTION AND ARE ONE OF THE FEATURES UNDER CONSIDERATION FOR NEW TELEVISION SERVICES BASED ON THE UHD FORMAT. BBC'S **ANDREA GABRIELLINI** INTRODUCES RECENT RESEARCH ON THE TOPIC.

The Broadcast Technology Futures (BTF) group has studied the visual impact of higher frame rates on television viewing since the beginning of 2013. The research labs of BBC, IRT, NHK, RAI and the EBU have collaborated to provide a scientific understanding of the issues related to HFR in broadcasting. As part of the BTF activities a study of the impact of HFR on video compression was carried out during 2013.

CODING HFR

NHK and BBC R&D provided the HFR content for the BTF coding tests; all sequences were of HD resolution and originally shot at frame rates ranging between 240fps (frames per second) and 600fps. The reference implementation of the HEVC/H.265 video coding standard (HM 10) was used for all tests. Visual inspection by expert viewers and a set of subjective tests at IRT's premises* were used to evaluate the results of the experiments. While analysis of objective measurements, such as PSNR (peak signal-to-noise ratio), is often used to evaluate the performance of video encoders it was felt that it could not be adopted here when the comparison was between video signals at different frame rates.

Overall the tests have shown that a few elements contribute to the bitrate overhead associated with HFR. The increased temporal resolution means that we are feeding our encoder at least twice as much data; state-of-the-art codecs, however, are particularly effective at removing temporal redundancy from the video signal and thus the bitrate overhead due to the increased temporal resolution is fairly limited.

A HFR signal also tends to be captured with a shorter exposure time, typically generating sharper pictures with a more marked sensor noise. Both features, higher spatial frequency content and sensor noise, contribute to the bitrate overhead and are usually responsible for most of it.

Finally HFR is also susceptible to flicker from lighting; preliminary tests have shown that a moderate amount of flicker can increase the bitrate by up

Sequence	Bitrate difference: 60fps vs 120fps
Baseball09	4%
Meruhenk	4%
Runner	10%
Shuttle	8%
Skating	7%
Soccer	3%
Swing	21%
Average	8%

TABLE 1. HFR VIDEO BITRATE OVERHEAD

to 8%. Pre-processing the video signal prior to encoding could help mitigate flicker and sensor noise, dramatically reducing the bitrate overhead.

TEMPORAL SCALABILITY

Temporal scalability is a video codec feature allowing support of different frame rates within a single bitstream. HEVC/H.265 Main and Main10 profiles support temporal scalability. Tests performed by the BTF group have shown that the bitrate difference between streams at different frame rates was very modest. Table 1 shows results for content at 120fps; the bitrate overhead between streams at 60fps and 120fps is 8% on average with a maximum of 21%. Similar percentages were obtained for content at 100fps (with 50fps content derived from the same bitstream).

Temporal scalability has a specific drawback, however, which may make it unsuitable in some applications: the content derived at the lower rate has a shorter shutter than would normally be used. Depending on the nature of the content, the display characteristics and the frame rate, the shorter exposure time can cause strobing. Improvements in

display technology could soon mitigate the effects of strobing and the BTF group has already planned to study motion-compensated frame insertion techniques.

SUBJECTIVE TESTS

The BTF group performed subjective tests at IRT's premises in August 2013 using two modified displays (52", kindly provided by NHK) capable of showing frame rates up to 240 Hz. The tests were based on five sequences, each coded (directly, no temporal scalability) at 60fps and 120fps. Preliminary results have shown that for most of the content the subjective quality improvement provided by HFR is maintained when compression is applied to the video sequences. Moreover for four of the five sequences the subjective improvement was obtained for no increase in coding bitrate. More tests with a larger selection of content are required to confirm these early findings.

**The BTF group has also studied other aspects related to HFR, such as the subjective impact of different frame rates and exposure times. See issue 18 of tech-i magazine.*

ACKNOWLEDGEMENTS

We are grateful to our fellow BTF members for their help throughout 2013. Special thanks to NHK for providing the HFR panels, IRT for organizing and running the subjective tests and the EBU for its leadership.

Harnessing the potential of MoJo

MOBILE JOURNALISM HAS BEEN MAKING WAVES ACROSS THE BROADCAST INDUSTRY, WITH SOME SEEING IT AS THE ANSWER TO FUTURE NEWSGATHERING NEEDS AND OTHERS WORRIED THAT IT DEVALUES THE PROFESSION. IRELAND'S RTÉ HAS BEEN ONE OF THE PIONEERS, EXPLAINS **GLEN MULCAHY**, INNOVATION LEAD IN RTÉ'S TECHNOLOGY DIVISION

For the last three years RTÉ has been researching, testing and developing a mobile journalism training programme to allow it to leverage the full potential of mobile devices for content production in the field. I was part of the team that, in 2001, introduced Video Journalism to RTÉ. In many ways the Mobile Journalism (MoJo) project epitomises the “one person does everything” ethos of Video Journalism.

In the early stages of the project we collaborated with a team of journalists and engineers to examine the various possible uses for smartphones with regard to the core output channels of RTÉ: radio, online and television. Radio was an early adopter as several pro-grade applications appeared on the market for radio quite early on. Among the ones RTÉ tested were Tieline's ReportIT and Technica Del Arte's Luci Live. My former colleague Cyril Ryan led that radio initiative.

It became obvious very quickly that the iPhone offered huge potential, whether for prerecording audio clips and sending them via FTP or live streaming two-way radio interviews. Though the audio quality from the in-built microphone on the iPhone 3G was pretty good we set about exploring alternative audio options and accessories. Vericorder, an iOS App developer from Canada, had come up with a cable to connect a standard XLR microphone to the headphone/microphone socket on the iPhone. In the first phase of the project this was the solution used to get better quality audio.



RTE MOJO GRAB BAG
 ROLLEI FOTOPRO BAG & TRIPOD
 MOPHIE JUICE PAK PRO POWERSTATION
 METZ MECALIGHT LED160
 IKMULTIMEDIA IRIG PRE
 AKG C417PP LAVELIER PIC
 BAYER DYNAMIC M58 REPORTER MIC
 VODAFONE MIFI
 SENNHEISER MKE400
 PHOCUS ACCENT 3 LENS SYSTEM

THE EQUIPMENT AND APPS

We meanwhile set about finding and testing accessories to improve the video potential for TV newsgathering. At the time the OWLE Bubo (an aluminium iPhone holder with several tripod mounts) was gaining popularity. In the first iteration of our Mojo kit, this was selected as the preferred tripod mount.

Not long after the Fostex Ar4i, an alternative mount that offered two microphone inputs via the 30-pin dock connector, was added. This gave the potential to use both a radio mic set and a directional microphone for stereo audio. The shape of the Fostex dock was such that it allowed the top third of an iPhone to protrude; as luck would have it this accommodated a lens system called the Olloclip. The creation was christened the FrankenCam.

The FrankenCam was used on several test stories to see how it performed in the field and the results were generally very good. By now the iPhone 4 was available and the 720p video from the native camera app was pretty impressive.

Around the same time Cinegenix launched a new video camera app for iPhone, FiLMiC Pro. The app was aimed at the new generation of aspiring filmmakers who were beginning to push the boundaries with iPhones. When we saw Apple of my Eye, a short film shot on iPhone by Michael Koerbel, we realized that mobile video was about to explode. Having tested FiLMiC Pro we immediately adopted it as the camera app of choice for our MoJo production

model. One of the immediate benefits was the ability to lock focus and exposure independently; it also features variable frame rates, sample rates and an audio monitor on screen. (I outline the process in this short video: <https://vimeo.com/30263550>).

In the early stages we looked at the BBC project where they invested in the development of a dedicated app for newsgathering, PNg. However, our discussions with app developers indicated the costs of “white label” licences would be prohibitive for us. From that point we focused on testing the huge variety of apps that were already available for download.

At this stage we started to present the project to various managers and teams within RTÉ to garner reaction and feedback. RTÉ had just appointed a new CTO, Richard Waghorn, and mobility had been identified as a key element of the new technology strategy. The CTO agreed to the purchase of fifteen MoJo kits, and to champion the trial of mobile journalism within RTÉ with a specific emphasis on news.

GRAB BAG

By the end of 2012 the equipment was on its third iteration and we had abandoned the OWLE and Fostex mounts in favour of the lighter and cheaper Smart Phocus Accent. The other key difference was that the entire kit, including tripod, now fitted into one neat bag.

We continued to research and iterate the Mojo equipment adding an external

LIVE STREAMING REPORTS FROM LONDON OVER A 4G USB MODEM.



battery pack from mophie and using the IK Multimedia iRig PRE as the audio interface, allowing any XLR microphone to be used with the iPhone and offering gain control and phantom power.

One of the key aspects of our approach however was not to develop a solution just to improve “reactionary” newsgathering (fires, crashes, etc), but instead to create a production toolkit which could, if used within the scope of our MoJo training course (developed in conjunction with Circom, a professional association of regional public TV stations), produce results that were almost on a par with higher end VJ cameras. Thus, for example, several RTÉ staff members have, using their iPhones, shot and edited entire feature stories that have been broadcast on TV as well as

online. The audience reaction has been very positive.

There is a misconception that mobile footage should always be reactionary, spontaneous, which results in it usually being handheld and shaky with awful audio. This is derived from the prolific use of user-generated content from mobile devices on air. However, what differentiates our project from mobile newsgathering initiatives elsewhere is that we have proven that the results from mobile devices, when used within a simplified VJ training framework, can be very impressive indeed. The key thing is that journalists realise the potential of the device in their pocket - it is an HD camera, an editing system, a live streaming system, a research toolbox, a pocket computer and it also makes calls and sends SMS messages.

THE 4G QUANTUM LEAP

In the last few months the 4G network has gone live in Ireland and we’re now looking to adopt iPhone live video streaming in the same way that Sky News has in the UK. RTÉ has used Quicklink as its IP-based video streaming solution for the last five years. Piotr Kaszynski, technology manager in RTÉ News, tested the very early version of their live streaming app for iPhone, Quicklink LNG, well over a year ago but for a series of reasons it was decided to wait until the 4G network arrived to pursue it further. With peak upload speeds in excess of 10 Mbps we are now aggressively pursuing this with our mobile service provider Vodafone Ireland. In fact RTÉ’s enthusiasm for 4G was recently heightened as a result of one of our ENG people, Michael MacSuibhne, taking the initiative to buy an EE 4G USB modem while in London and subsequently live streaming a total of 100 minutes of content over the course of the three days he was on location. The results, streaming at 1 Mbps were very good indeed.

PANACEA FOR NEWSGATHERING?

Mobile is not yet the cure-all for mobile journalism, but it should be a part of a broader strategy. The most important part of this project has been developing a solution that acknowledges that the news market is shifting and responds to that. The transition from appointment viewing to on-demand TV, wherever, whenever, is one of our key challenges going forward. The audience is consuming content continually throughout the day, much of it fuelled by social media. By the time they sit down to watch our evening news bulletin on TV, many will already know the news topics/stories and may well have been actively monitoring their development over the course of the day. This is a fundamental shift in how the audience consumes news, so it presents us with a challenge of how to engage audiences in a new and meaningful way.

Going forward MoJo gives us the potential to contribute more content to that process. This could include photos, multimedia presentations, video clips, interviews, edited stories or even live video Q&As. Stories are no longer confined to 1’30” of TV exposure and republishing online. The audience follows the story arc over the course of the day, so we too must contribute to that discourse as it happens. But importantly we must use our unique selling points – journalistic integrity, ethics and accuracy – to bring our verified and trusted voice to our audience when and where they want to hear it.

Media Information Management

THE SIX SUBGROUPS OF SP-MIM COVER A RANGE OF TOPICS OF STRATEGIC IMPACT FOR EBU MEMBERS, ALL FALLING UNDER THE BANNER OF MEDIA INFORMATION MANAGEMENT. PROGRAMME CHAIR **ALBERTO MESSINA** (RAI) AND THE PARTICIPANTS OF SP-MIM PROVIDE THIS UPDATE ON THEIR ACTIVITIES AND OUTPUTS.

Media Information Management is all about the standards, practices and technologies aimed at capturing, managing, extracting, indexing and retrieving explicit information all across the media value chain. This should be done through the use of well-established conceptual and process models. The EBU's Strategic Programme on Media Information Management, SP-MIM, oversees six different project groups.

The Metadata Models (**MIM-MM**) group has been developing the EBU's flagship scheme for exchange of metadata, EBUCore (Tech 3293), and a supporting conceptual data model, CCDM (Tech 3351). The group is just now focused on extending EBUCore with a comprehensive model for audio metadata, which can be mapped to different file formats (e.g. BWF and MXF). The group liaises worldwide with many standardization bodies, including SMPTE, AES, W3C and MPEG, with a view to harmonizing the different approaches to the same problems. Recently the group has collected an overview of metadata specifications, reference data and information about semantic web projects done by EBU Members. The group has developed and currently maintains other key metadata models like egtaMeta (Tech 3340) and a comprehensive set of classification schemes for reference data.

Since it makes no sense developing metadata standards that are not used, MIM-MM works closely with **MIM-MDN**, the Metadata Developers Network, whose aim is to help in the process of using the standards in practice. The most important activity is the annual MDN Workshop, a two-day event where experts and users of metadata meet and exchange experiences and knowledge. The fourth annual workshop will be held in 2014; and the presentations are available to all EBU members.

The activity of the **MIM-FIMS** group is on the one hand to promote EBU Members' technologies and priorities within FIMS and on the other to keep Members updated on FIMS specification releases. The complete set of EBUCore elements specified in Tech 3293 is included in the new FIMS 1.1 specification, although published as SMPTE RDD24. MIM-FIMS has also been active within the FIMS Business Board in the selection of the next services to be modelled by FIMS. The Quality Analysis service is now under development in co-operation with SP-QC and a Metadata Extraction service is on the shortlist of possible next activities to be launched. (See opposite.)

The **MIM-XMLSubs** group develops subtitling data formats. The group provided a follow-up solution for the widely used, but aging, EBU STL subtitling format, originated in 1991 and strongly linked to the specifics of Teletext and 3.5" floppy disks. The new format, EBU-TT based on XML, supports subtitling for many different platforms. The group covered the main use cases across the content chain, ranging from archiving and exchange (Tech 3350) and legacy file mapping (Tech 3360) to subtitle distribution over IP (Tech 3380). Having addressed the production and exchange of prepared subtitles, now the focus is on Live Subtitling, due to the increasing relevance of the authoring, contribution and reuse of real-time created subtitles in many broadcast operations. This is to guarantee efficient and future-proof workflows in this domain.

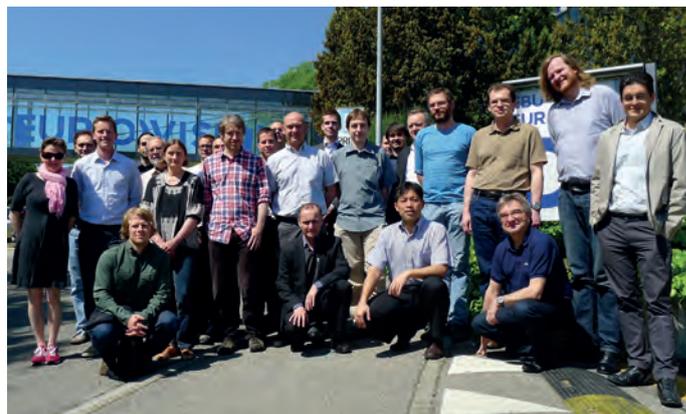
SP-MIM PORTFOLIO

Tech 3293	EBUCore Metadata Set
Tech 3295	P_META Metadata Library
Tech 3336	Classification Schemes
Tech 3340	egtaMeta
Tech 3349	Acquisition Technical Metadata Set
Tech 3350	EBU-TT Part 1 – Subtitle Format Definition
Tech 3351	Class Conceptual Data Model
Tech 3352	Carriage of Identifiers in BWF
Tech 3356	FIMS v. 1.0.7 (with AMWA)
Tech 3360	Mapping EBU STL to EBU-TT Subtitle Files
Tech 3380	EBU-TT-D Subtitling Distribution Format
Tech 3381	Carriage of EBU-TT-D in ISOBMFF

The **MIM-SCAIE** group is studying the application of automatic information extraction tools in media production settings such as media archives management, content selection and editing, subtitling, etc.. The group collects use cases and defines evaluation methods for tools, intending to bridge the gap towards the concrete adoption of technologies mature enough to apply in real media production environments. A highlight has been the creation of the MPEG-7 AVDP profile, an ISO standard for storing results of automatic annotation techniques, and for which usage guidelines will soon be finalized. The material collected by the group has recently been accepted as a standard reference dataset by ACM Multimedia Systems.

Finally, the **MIM-AM** (Acquisition Metadata) group has been mainly focused on metadata generation by modern cameras and camcorders. Aiming to improve systems interoperability and prevent the co-existence of different competing implementations, the group has specified a set of common metadata sets for camera/camcorder devices, lenses and microphones in Tech 3349.

For more information see the SP-MIM homepage (<http://tech.ebu.ch/mim>), and dedicated pages for metadata (<http://tech.ebu.ch/metadata>), EBU-TT (<http://tech.ebu.ch/ebu-tt>) and FIMS (<http://wiki.amwa.tv/ebu>).



SINCE IT MAKES NO SENSE DEVELOPING METADATA STANDARDS THAT ARE NOT USED, THE METADATA DEVELOPERS NETWORK IS A KEY PROJECT GROUP

Going further with FIMS

THE 2012 PUBLICATION OF THE FIMS 1.0 SPECIFICATION WAS A MEDIA TECHNOLOGY MILESTONE - DULY RECOGNIZED BY THE IBC JUDGES' PRIZE. NEW SERVICES HAVE SINCE BEEN ADDED AND USERS ARE STARTING TO DEMAND FIMS SUPPORT FROM SUPPLIERS, SAY **GIORGIO DIMINO** (RAI) AND **JEAN-PIERRE EVAÏN** (EBU).

FIMS is on schedule and continues delivering new SOA (service oriented architecture) interface definitions for the professional media industry under a royalty-free framework, making this technology accessible and affordable. Although originally involving mainly vendors, more users are now indicating their desire to adopt FIMS, making its support a requirement in their calls for tender. Undoubtedly the new service interface for repositories, the REST reference implementation and the forthcoming solutions for quality analysis will be accelerating factors.

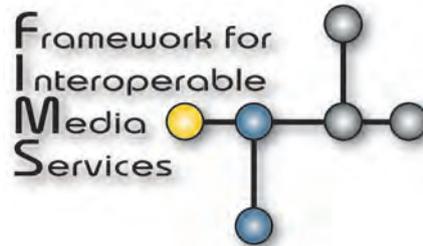
At a high level, FIMS – the Framework for Interoperable Media Services – establishes a framework within which different media services can communicate, allowing for the rapid configuration, deployment, and modification of media workflows. Some of the benefits of a service-oriented approach include improved efficiency, agility, scalability, access to best-of-breed implementations, facilitation of code reuse, and avoidance of single vendor lock-in. The FIMS 1.0 specification, available as EBU Tech 3356 and SMPTE RDD 24, addresses three fundamental services – Transfer, Transform and Capture.

USER-DRIVEN

FIMS activities are user-driven, and users have submitted a list of services that they would like to see developed. The set of service definitions is expected to grow in the future.

FIMS services are designed to satisfy ever-shifting requirements for the preparation, transmission and ultimate consumption of media content. The FIMS effort has brought together end users, manufacturers, system integrators and IT specialists to deliver on this vision, which allows FIMS specifications to be developed in full awareness of other industry developments and user requirements. The Technical Board of FIMS counts around 90 member companies.

Work that has taken place under the leadership of Bloomberg/Triskel, who chair the FIMS Technical Board,



is the creation of a new set of service definitions for managing repositories. Media organizations having to serve a growing number of new distribution channels need to access media assets located in many repositories (MAM, DAM, FileStorage, etc.) with discrete integrations for each. The repository interface exposes a set of operations needed by an application and/or orchestration engine to leverage a media repository as a service within a media workflow. Create, Read, Update and Delete (CRUD) operations are available to manage all properties of a media asset including metadata, content format and essences. An event-driven model based on a standard SOA pattern is available as part of the interface to handle data synchronization and state management. The repository specification will be released at NAB in April 2014 as part of the extended FIMS 1.1 specification.

QUALITY ANALYSIS

The most recent project started by FIMS is on quality analysis (QA), led by Interra. The FIMS QA Charter provides recommendations for a standardized FIMS-compliant API, exposing capabilities oriented around analysis and reporting of asset properties (e.g. audio and video parameters or container structure compliance or integrity) identified in cooperation with the EBU Strategic Programme on Quality Control. The service will extract/provide

information and report pass/fail via the analysis of parameters defined in pre-set profiles. A higher level service can then determine how to act on the information.

FIMS will also work on better support for timecode to manage partial content. This will greatly expand the application of existing and future services to use cases where specific parts of content need to be addressed, including dynamic metadata and conformance.

One other FIMS project that has been established is to specify a RESTful binding of the published FIMS 1.1 services, along with a reference implementation, test suite and examples. This work is led by Quantel. These will complement the existing WSDL/SOAP bindings and reference implementation and will offer the same service capabilities. The group has defined a representation of the FIMS data model using the popular JavaScript Object Notation (JSON) format. The REST specification will also be released as part of FIMS 1.1.

FUTURE PLANS

The FIMS Business Board, chaired by Turner, is exclusively composed of users and is now defining what additional services should be addressed. Several options are being considered: advanced metadata management, media search and retrieval, advanced transform and other MAM related processes. FIMS is also working with SMPTE on identifying the requirements for a FIMS service for IMF (interoperable master format).

FIMS will be present at NAB in the Research Park, North Hall, from 7 to 10 April 2014.

More: <http://www.fims.tv>
Contact: fims_adm@list.ebu.ch

FIMS BUSINESS BOARD MEMBERS

A&E, ABC, AD-Id, AMWA, BBC, BCE Luxembourg, Bloomberg, BskyB, CBC, Cognizant, EBU, ESPN, Fox, HBO, ITV, Mescaldo, MLB, MTV, NBCU, NFB Canada, NRK, Prisa Digital, RAI, RedBee Media, PBS, Sony, Triskel, Turner Asia Pacific, Turner UK, TV-Globo, Viacom.

EBU-TT-D is online

THE NEW SUBTITLING FORMAT PROVIDES AN EASY WAY TO DISTRIBUTE SUBTITLES TO IP-CONNECTED DEVICES. IT IS LOW IN COMPLEXITY, BUT FLEXIBLE ENOUGH TO SUPPORT ALL COMMON SUBTITLING CASES. **FRANS DE JONG**, EBU, COORDINATES THE PROJECT GROUP.

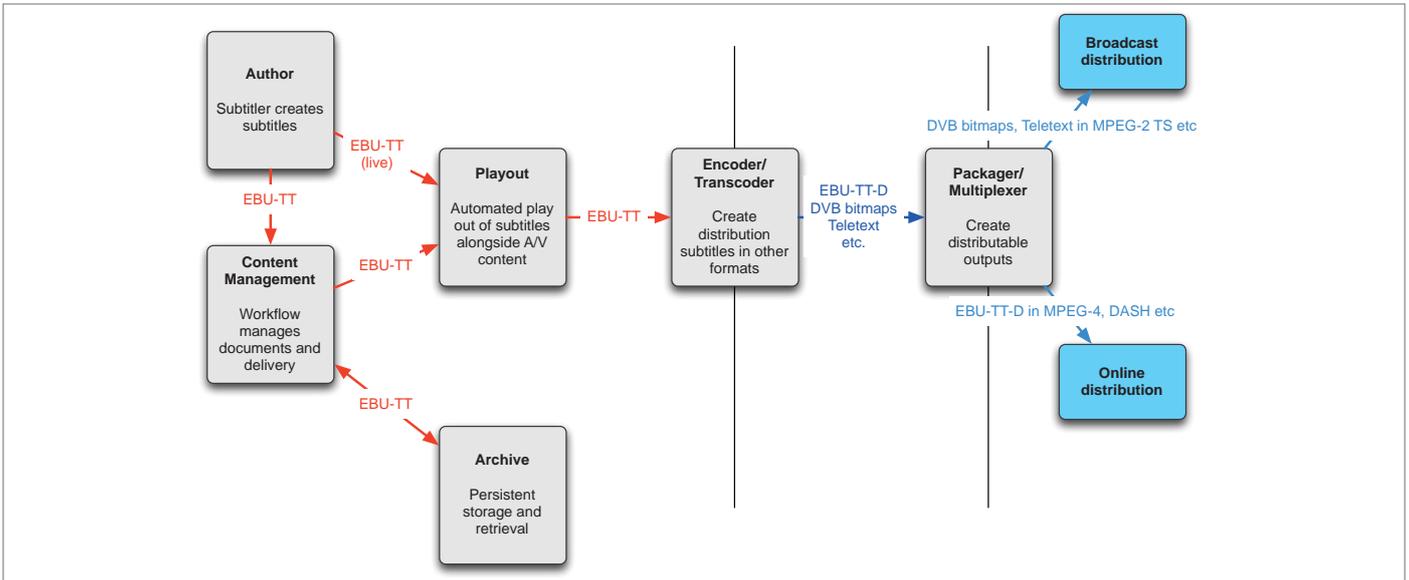


FIG. 3. ILLUSTRATION ILLUSTRATION OF THE USE OF EBU-TT IN A TYPICAL SUBTITLING CHAIN.

In January the subtitling distribution format EBU-TT-D was published. It is the result of nine months of hard work by the EBU group chaired by Andreas Tai (IRT) and Nigel Megitt (BBC). The development of the format was fast-tracked following strong demands from EBU Members and the HbbTV Association to develop a subtitling specification for use with, among others, OTT services and catch-up TV websites.

DESCRIBING THE UNDESCRIBABLE LOW COMPLEXITY

EBU-TT-D uses three core concepts: subtitles, styles and regions. A subtitle consists of a snippet of text with timing information. It can be assigned a style, such as font-type and colour, and placed in a region, which determines where the text shall be shown on the screen. Regions can be defined as desired by using metrics that are relative to the video dimensions.

EBU-TT-D is derived from the W3C TTML format, but it only allows a subset of the TTML functionality to be used, because the main design requirement was to create a low-complexity solution. Basically, all options which are not commonly used in subtitling or which provide alternative ways of doing the same thing have been removed. The specification also tries to help by not allowing subtitles to overlap on-screen, or to use animations, as this would ask for more powerful rendering engines than are needed for

typical subtitles. And by using relative metrics instead of pixel counts, EBU-TT-D allows for simple scaling of subtitles for different screen resolutions.

TWO ELEGANT EXTENSIONS

EBU-TT-D does however introduce two new features which do not exist in the current version of TTML. The first is a way to align multi-row subtitles in relation to each other. This so called `multiRowAlign` feature is illustrated in figure 1. The first two rows are left-right and the following center-left aligned.

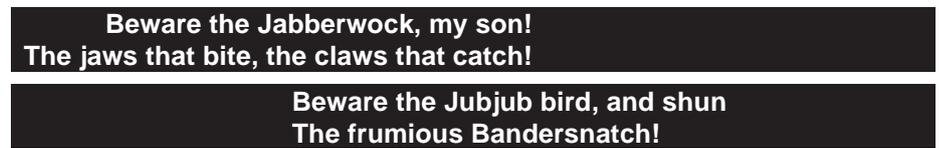


FIG. 1. `MultiRowAlign` ALLOWS FOR BLOCK-STYLE ALIGNMENTS NOT POSSIBLE WITH TTML V1.0

The second feature enhances readability and makes online subtitles appear more similar to the ones we are used to seeing on television. The `linePadding` feature allows for the background to be extended to the left and right of subtitle text (figure 2).

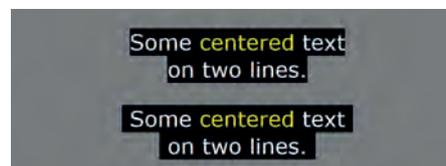


FIG. 2. ILLUSTRATION OF HOW `linePadding` (BOTTOM) IMPROVES THE RENDERING OF SUBTITLES.

These two (single-attribute) features are elegant additions in the sense that they allow for graceful degradation. Should a rendering device not support them for whatever reason, then the subtitle information will still be displayed, so no information will be lost.

TRANSFORMATIONS

EBU-TT-D fits nicely with the EBU-TT production format (Tech 3350) published in 2012 (figure 3). The production format is richer in features, but can be

automatically transformed into the simpler EBU-TT-D profile. An example would be the filtering of production metadata prior to online distribution.

Another transformation concerns how to segment all subtitles of a programme into individual chunks that are sent over an IP connection. This is important as for typical streaming applications the subtitles are likely to not be sent all at once, but one-by-one, each of them in a small, self-contained EBU-TT-D document. This process is carriage mechanism dependent. For the technology used by MPEG-DASH, ISO BMFF, the EBU already provides brief guidance for implementation (Tech 3381).

Polish Radio

SINCE 1994 PUBLIC RADIO AND TELEVISION HAVE BEEN SEPARATE ENTITIES IN POLAND. POLISH RADIO'S CHIEF ENGINEER **PAWEŁ MATHIA** EXPLAINS HOW THE ORGANIZATION HAS KEPT PACE WITH TECHNOLOGY THROUGH THE YEARS.

Polskie Radio S.A. began operating in 1925. The broadcast license act granted the broadcaster the right to broadcast radio (and television!) channels throughout Poland. As soon as the permits required had been obtained, the development of the radio network started. A significant achievement in the 1931 was the commissioning of the longwave station in Raszyn covering the whole country. This was the strongest LW station in the world at that time.

The post-war period saw gradual reconstruction of damaged infrastructure, the launch of new regional stations and the implementation of FM broadcasting. In the 1950s, television broadcasting began. Until 1994, public radio and television functioned as one company, but the turn of 1993 and 1994 became a crucial time.

On the basis of a government act of 28 December 1992, public radio and television were separated; moreover, 17 independent regional stations were sectioned off from Polskie Radio. The former head office, still called Polskie Radio S.A., is responsible for the broadcast of four Poland-wide channels and the international service as well as a number of specialised channels available on the internet only, and the content available on the PRSA website. (Regional stations broadcast only to their regions.) Polskie Radio employs 1,215 people in three buildings in Warsaw and in the longwave station 225kHz AM in Solec Kujawski. Also under PR's structure are two orchestras, in Warsaw and Poznan.

In October 2013, the launch of DAB+ digital broadcasting was another breakthrough. The multiplex launched in the Warsaw and Katowice regions covers over 7 million potential listeners. In the DAB+ multiplex, there are all of PR's analogue services as well as two new digital-only services and two services dedicated to the stations in each region. PR plans to launch three new DAB+ services in the future. As the DAB+ network expands, targeting full coverage by the end of 2020, the broadcast of additional data, including TPEG information essential for road traffic, is also being developed.

TECHNOLOGY UPGRADES

After Polskie Radio and Telewizja Polska were separated in 1994, both production and distribution were modernised,



replacing analogue technology with digital. In 1996, Polskie Radio launched a satellite distribution system enabling the signal to be sent to all transmitters and reducing the costs of operation. The system has been modernized recently and has been adapted to IP technology.

In 2000, a production system based on Dalet's solutions was implemented and was gradually developed to the point where tape was abandoned in 2005. In 2002, the NEXUS digital network combining all studios was launched and analogue consoles were replaced with digital ones. A data centre was created in 2004 to facilitate and secure the IT infrastructure. It provides optimal conditions for numerous servers, disc matrices and data archiving devices including virtualization.

Polskie Radio S.A. regularly broadcasts in the 5.1 Dolby Pro Logic II surround sound on FM. The first broadcast in this format took place in May 2009.

ARCHIVES

The pride of Polskie Radio is its archive, including more than one million items. In 2005, the process of resource digitization was started with a Pyramix system using the WAV PCM recording format (24 bits, 96 kHz, stereo/mono). Later, lossless compression in FLAC containers was performed. By the end of 2013, 32% of analogue storage devices were digitized, which means that approximately 42% of

all recordings have their digital counterpart now.

As part of the development of a digital archive and making it available for the radio production process, since 2011 the archive has used the Media Asset Management class (integrated with Dalet). The public broadcasters in Poland, namely PR, TVP and 17 regional stations, are cooperating on implementing a platform for exchange and sharing of archive resources.

NEW PLATFORMS

Taking advantage of the digitization of archive resources and with a view to extending the programme offer, 100 thematic channels have been made available on the PR portal since 2010. Today, all of Polskie Radio's services are available online and on mobile devices. A significant part our output is available through the polskieradio.pl website on-demand. In 2013, over 21 million users generated nearly 62 million visits. Polskie Radio's listeners more and more often use the newest 2014 version of our smartphone and table apps (Android, Windows and iOS).

Further modernization and development of infrastructure will use IP-based solutions. This will simplify all processes related to the production of multimedia content intended for new distribution platforms.

Can DVB-T2 cope with the spectrum shortage?

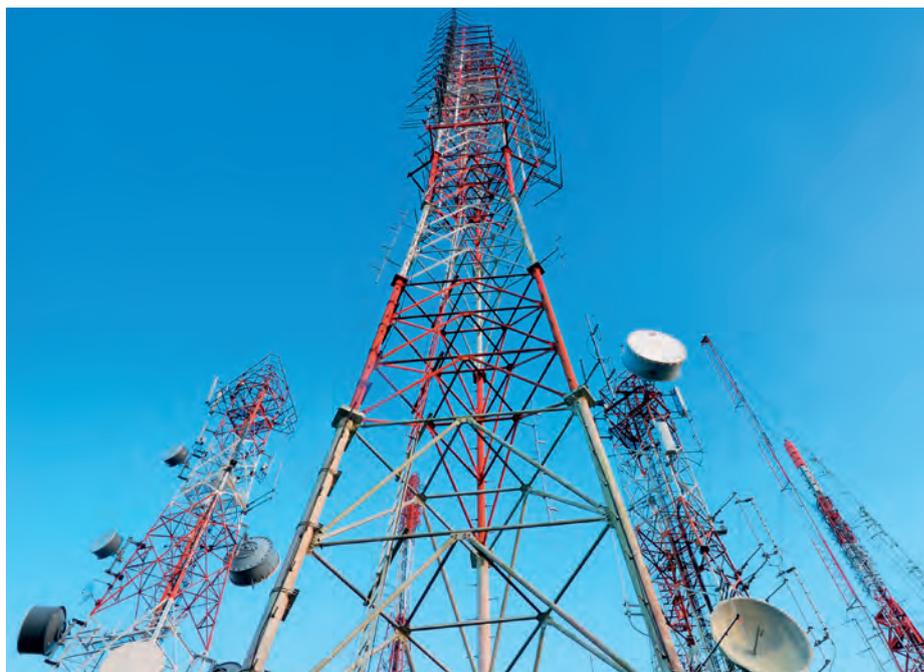
DIGITAL TERRESTRIAL TELEVISION IS WELL ESTABLISHED IN EUROPE. SUCCESSIVE TECHNOLOGICAL LEAPS HAVE MADE SERVICES MORE ATTRACTIVE AND RELIABLE. BUT, ASKS THE EBU'S **ELENA PUIGREFAGUT**, WHAT ARE THE IMPLICATIONS OF THE SPECTRUM SQUEEZE AND THE ARRIVAL OF UHDTV?

Terrestrial is the preferred digital television platform for EU citizens.* The first version of the DVB-T standard was published in 1997, appearing as a revolutionary solution to solve some of the constraints associated with analogue television. At the time these included the lack of spectrum capacity for terrestrial television and the high requirements of analogue television systems for protection against interference. This limited the number of services that could be delivered via the terrestrial platform, putting it in an extremely difficult situation compared to other emerging platforms (cable, satellite and later IPTV).

DVB-T provided the solution: multiple TV programmes could be transmitted in a given radio frequency channel and a more robust system could allow more efficient use of the limited spectrum. Of course those two advantages are mutually exclusive. If a system is maximized in terms of capacity (i.e. bit rate or number of programmes per channel), it is penalized in terms of robustness (i.e. higher required C/N ratio or higher sensitivity to interference). Nevertheless, as of today most European countries have already switched off analogue television and have successfully deployed a competitive digital terrestrial television (DTT) platform. A great part of the success came from the GE06 Agreement that planned for DVB-T in the VHF (174-230 MHz) and UHF bands (470-862 MHz). Seven to eight nationwide DTT multiplexes in the UHF band were planned for those countries targeting fixed reception. For those targeting portable reception (thus requiring a more rugged system variant) six to seven nationwide DTT multiplexes were planned.

Despite the success of DTT, today in 2014, the terrestrial platform is facing again a lack of spectrum capacity as in the 90s. The spectrum made available to DTT is reducing as regulators see mobile broadband services as a more lucrative use of the UHF spectrum:

- The 800 MHz band (790-862 MHz) has been harmonized in the EU for mobile services and many European countries



have already released the band from DTT.

- The 700 MHz band (694-790 MHz) will be allocated to mobile services on a co-primary basis with broadcasting services at the World Radiocommunication Conference in 2015 (WRC-15). Some European countries have already announced that it will be released from broadcasting or are considering it (e.g. Finland, France, UK, Germany, Switzerland).

This represents a reduction of around 43% of spectrum available for DTT compared to the GE06 Plan.

NEXT GENERATION

Again, the solution may come from a more spectrum efficient system. DVB-T2 is considered the most advanced DTT system. This second generation standard includes new or improved features related to modulation parameters, error correction and use of bandwidth, each delivering gains in capacity and/or robustness.

The overall increase in capacity compared to DVB-T will vary from country to country depending on the choice of the different COFDM

parameters. The table opposite shows three examples of possible implementation scenarios and compares the DVB-T and DVB-T2 capacity requirements of a single multiplex.

For the examples shown in the table, the DVB-T2 capacity gain is from 40 to 46% for the scenarios with similar C/N requirements. A higher efficiency gain appears in the "Portable SFN" scenario but it implies the use of a less robust system than the DVB-T case. These efficiency gains correspond well with the 43% spectrum reduction if both the 700 and 800 MHz bands are not available for DTT in the future.

This means that if all other conditions remain the same moving from DVB-T to DVB-T2 would permit the retention of a similar DTT offer in the remaining 470-694 MHz frequency range. This applies to the current situation where most programmes are in Standard Definition. However, terrestrial broadcasters are introducing content with higher picture quality. Most European countries provide today some HDTV services and are considering the introduction of Ultra High Definition TV (UHDTV) in the longer term.

	Fixed MFN		Fixed SFN		Portable SFN	
	DVB T	DVB T2	DVB T	DVB T2	DVB T	DVB T2
Channel Bandwidth	8 MHz	8 MHz				
FFT mode	8k	32k	8k	32k	8k	16k
Carrier mode	Not available	Extended	Not available	Extended	Not available	Extended
Scattered Pilot Pattern	Not available	PP7	Not available	PP4	Not available	PP3
Guard interval	1/32 (28 Qs)	1/128 (28 Qs)	1/4 (224 Qs)	1/16 (224 Qs)	1/4 (224 Qs)	1/8 (224 Qs)
Modulation	64 QAM	256 QAM	64 QAM	256 QAM	16 QAM	64 QAM
Code rate	2/3	2/3	2/3	2/3	2/3	2/3
C/N	19.3	20.0 dB	19.3 dB	20.8 dB	14.2 dB	17.9 dB
Capacity (Data rate) per multiplex	24.1 Mbit/s	40.2 Mbit/s	19.9 Mbit/s	37.0 Mbit/s	13.3 Mbit/s	26.2 Mbit/s
Capacity gain per multiplex	40%		46%		49%	

MORE EFFICIENT CODING

The increase of picture quality requires a much higher bit rate, and therefore bandwidth, to be transmitted. DTT was originally introduced using MPEG-2 coding, but the development of a more efficient coding standard, MPEG-4 (H.264/AVC), provided the opportunity for HDTV in DTT networks.

However, while the new standard offers a gain compared to MPEG-2 for SD, HD still requires double the data rate of current SD programmes.

Although this may be reduced if statistical multiplexing is used it is clear that if the 700 and 800 MHz bands are lost for broadcasting, the DTT platform will not be able to migrate all current SD programmes to HD H.264/AVC.

Further improvement will come from High Efficiency Video Coding (HEVC). It is a new standard designed to improve video coding efficiency for different applications such as internet and mobile services, but it is also expected to deliver UHDTV to next generation displays.

It is too early to know what the bit rate gain will be with HEVC compared to H.264/AVC but taking into account the experience of H.264/AVC compared to MPEG-2, a gain of at least 30% can be expected with first generation HEVC encoders.

This is likely to increase to at least 40% in a few years when coding parameters are optimized based on experience. This fits quite well with the increase of bit rate of HDTV services compared to SDTV.

OTHER DVB-T2 FEATURES

The DVB-T2 standard includes a number of features that, although not yet widely deployed (if at all), have the potential to deliver further valuable gains in network efficiency and optimization.

- Increased guard intervals can extend and improve coverage compared to DVB-T by reducing SFN self-interference. Larger SFNs may ultimately improve spectrum efficiency, although the benefits may be limited for very large geographical areas because self-interference cannot be entirely overcome. Trade-offs are required between the size of an SFN, its robustness, its capacity and cost.
- MISO (Multiple Input Single Output), new to DVB-T2, is a network configuration where two slightly different versions of the wanted signal are transmitted from a number of sites simultaneously. This 'transmitter diversity' makes the network more robust with benefits to either coverage or data rate. MISO trials for portable reception in Germany have, however, not demonstrated significant gains compared to SFN and further trials are required.
- TFS (time-frequency slicing) transmits a number of statistically multiplexed

services over more than one radio frequency channel; up to six may be used. As the services jump around among the available frequencies, TFS delivers a kind of receiver diversity, especially important for portable/mobile reception. However, TFS is seen as an option only for future implementations, as it increases the complexity and therefore cost of the receivers. It also requires several channels of DVB-T2 spectrum to switch between to achieve the intended gains.

There is a need to further investigate how these DVB-T2 features can be used in frequency planning to improve the robustness and efficiency of a DTT network.

DVB-T2 will be necessary for broadcasters to maintain a competitive DTT platform offering – a nice 'bouquet' of television programmes – under the current pressure for spectrum. But an all-HDTV platform will require HEVC together with DVB-T2. The question then is how will UHDTV be introduced on DTT? Probably only for a few premium services initially.

*On average, in the EU over 45% terrestrial households, cable 31%, satellite 23%, IP TV 6% (from Special Eurobarometer 396, August 2013)

MORE INFORMATION

- EBU Tech 3348 r3 Frequency & Network Planning Aspects of DVB T2 (November 2013)
- EBU Tech Report 016 Benefits and limitations of Single Frequency Networks (SFNs) for DTT (October 2012)

A cool way to save

ONE OF RTP'S TRANSMISSION CENTRES NOW USES AN INNOVATIVE FREE COOLING SYSTEM, DELIVERING SAVINGS ON BOTH ENERGY AND COSTS. **CARLOS GOMES**, BOARD ADVISER FOR ENGINEERING AT RTP, PROVIDES AN OVERVIEW OF THE PROJECT.

RTP, the national public broadcaster in Portugal, is committed to reducing its environmental impact and taking a more sustainable approach towards broadcasting in general. It was with this in mind, along with the potential cost savings of course, that we launched the project to convert our Montejunto transmission centre to a *free cooling* system.

Free cooling is a term used to describe systems that take advantage low ambient air (or water) temperatures to control the temperature of industrial installations. The facility that RTP has converted to a free cooling system is located 80km north of Lisbon, at an altitude of 648m. It houses six FM transmitters, each rated at 2.5 kW. The project was a partnership between RTP and EDP (Portugal's largest power operator), and was built and installed by Schneider Electric.

Up to now the Montejunto transmission centre was cooled by a traditional air conditioning system. There were three units with a cooling capacity of 48,000 BTU (British thermal units) and one of 24,000 BTU, regardless of the outside temperature.

The new solution is based on a controller that is responsible for the operation of the entire system. It can be controlled manually or automatically, which ensures that the system will remain operable even in the case of equipment failure.

The system controls the temperature and humidity inside the facility. If the outside temperature is lower than inside the controller will operate the free cooling system. If the outside temperature is higher, the air conditioning systems will be used. In the case of humidity, the controller measures only the indoor humidity, ensuring that moisture does not exceed a certain set point.

There are other variables that affect the functioning of the system, such as wind speed and direction. It was found that under certain conditions the extraction fan is unable to remove hot air from the facility. The system takes these considerations into account to ensure that the transmitters are always kept cool.

Three fans supply air intake grilles, while three other fans are connected



INTERIOR OF THE MONTEJUNTO TRANSMISSION CENTRE SHOWING THE AIR INTAKE GRILLES. THE MARKS ON THE FLOOR SHOW THE FOOTPRINT OF THE OLD FAN SYSTEM, INDICATING THE CONSIDERABLE SPACE SAVINGS.

to the extraction grilles, which have motorised outlet vents. The extraction fans can dissipate the inside heat as required. The outlet vents can be closed during periods when the free cooling system is unable to function and the air conditioning system is working, to avoid the loss of cool air.

The system has a graphical user interface that can be accessed through a web browser. The operator uses a specific IP address to connect to the controller. The graphical interface shows the status of the equipment, along with historical data for the temperature, humidity, energy consumption, alarms and other events.

Using a few spare bits of capacity from the 2 Mbit fibre connection between the

production house and the transmission centre enables this remote control without any additional cost.

The target operating temperature of the system was set to 28° C, with 60% relative humidity. These settings can be modified via the graphical interface.

Based on the typical climatic conditions at the site, assuming a full year of operation (8,760 hours), energy use – and hence cooling costs – are reduced by around two thirds. (See Fig.1) As the project was eligible for a government subsidy for green projects, amounting to around half of the total project costs, the return on RTP's investment of €6,500 is fully covered in just 1.1 years. The benefits are clear!

	Electrical consumption of cooling equip. (kW/h)	Power consumption of cooling equip. (kW)	Annual cost of cooling (€)	Annual energy savings (kW/h)	Annual cost savings (€)
Without free cooling	108.010,80	12,33	9.116,10		
With free cooling	36.532,80	4,17	3.083,37	71.478,00	6.032,74

FIG. 1. ANNUAL ANNUAL ENERGY SAVINGS GENERATED BY FREE COOLING SYSTEM AT MONTEJUNTO TRANSMISSION CENTRE.



WITH UHDTV DOMINATING THE MEDIA TECHNOLOGY AGENDA IN RECENT MONTHS, **DAVID WOOD** CONSIDERS THE PHASES BEING PROPOSED FOR ITS INTRODUCTION.

“Why is it so complex? It’s a question of knowing what kind of UHDTV will be successful.”

Will UHDTV trip over itself?

I wish I was young enough to know everything. Even though we still have a long way still to go with HDTV, the world wants to know what to do about Ultra High Definition Television. The ITU defined the basis of UHDTV in ITU-R BT.2020 in 2012. But for the wisdom to know exactly what to do about it you need more than 20/20 vision; you will need a lot of careful analysis - and maybe second sight.

Why is it so complex? It’s a question of knowing what kind of UHDTV will be successful.

COMPLEX STORY

The story begins with the complication that the ITU Recommendation offers UHDTV with two complementary quality levels. They may complement each other - but they are significantly different. UHD-1 and UHD-2 allow respectively static image resolutions of about 8.3 Megapixels and (four times that) 33 Megapixels. Before getting down to the detail, wherein the devil lies, how do you decide which level of the two levels to go for? Looking across the world you find some broadcasters who believe the future lies with the lower level, and others who vote for the upper level.

Suppose for the moment that you are among those convinced that the future lies with the lower level, as many are; you are not out of the woods.

TV displays that are labelled as Ultra High Definition, and nominally provide the lower UHDTV level, are already on sale to the public. These do offer higher image quality compared to HDTV, but they don’t give all of the elements of the ITU-R UHD-1 standard. For set makers, the absent elements are not needed, and would raise the cost of displays to beyond the saleable. For many broadcasters and the movie industry, on the other hand, these absent elements are needed for the large jump in quality – compared to HDTV – that will mean success.

In parallel, we also find that the DVB Project suggests that, in order to allow for

HEVC decoder availability suitable for consumer electronics, two phases are needed for UHD-1. Decoders for the full spec UHD-1 will not be available until 2017/18, so it will be necessary to introduce a lower spec UHD-1 Phase 1 for those who want to start in 2014/15. Later on there can be a higher spec UHD-1 Phase 2. The details of what Phase 2 will include are still under discussion.

Think you understand the situation now? Sorry, not yet. There is talk of a UHD-1 with an ad hoc title Phase 0.5 that may emerge for broadband internet delivery of UHDTV. Broadband internet will become ever more important for media delivery, so we need to pay attention to this.

We expect the de facto details of Phase 0.5 to emerge in the coming months. For internet delivery to cope with congestion, not only may the starting point for UHD-1 be lower than full spec UHD-1, but services will probably need to use adaptive streaming, so the quality the viewer gets could be, well, just about anything.

NO FURNITURE EFFECT

But if any or all of these phases do make sense, we may wonder how long it will take for them to take hold. The growth of UHDTV reception may well be slower than the growth of HDTV reception. HDTV rode to success on the new furniture of the flat screen display. Albeit with larger screens, this extra element will not be there with UHDTV, so we cannot rely on the furniture effect to sell UHDTV to the public.

But hold on: NHK in Japan estimates that UHD-2 consumer displays – the next level up - will be available from Chinese set makers in time for the Olympic Games in 2020, just six short years away.

Are we entering an age when the speed at which media technology can be popularized is slower than the speed at which there are significant technology advances? If so, nervous breakdown aside, what can we do about it? What do you think?

Outsourcing streaming at DR

DR LIVE STREAMS ALL OF ITS RADIO AND TV CHANNELS AND IN ADDITION PROVIDES A LARGE AMOUNT OF ON-DEMAND CONTENT FOR STREAMING. **NIELS SENNICKSEN** AND **THOMAS ELTON JENSEN** DESCRIBE WHY AND HOW THE DANISH BROADCASTER DECIDED TO OUTSOURCE PARTS OF THE STREAMING OPERATION IN 2013.

Until December 2013 all content was streamed from our own server infrastructure hosted at DR's main site DR Byen in Copenhagen. As we owned all infrastructure, we had to keep a sufficiently large server, network and storage infrastructure operational to meet the demands of peak events with the quality of experience expected by the Danish audience from the public service broadcaster, to which they pay their license fee.

Traffic volumes have grown around 40% annually in recent years and DR had already in 2012 reached the point where the existing connectivity from DR's own building didn't support the requirements. A significant one-off investment would be necessary. We also experienced problems around the ability to release new services and to reach new devices as quickly as we liked.

To reduce the need for fixed investments and move towards a more flexible model, DR decided to outsource parts of its streaming operations in late 2012.

OUTSOURCING STRATEGY

Driving the decision to outsource parts of DR's streaming operations were the two key ambitions of the organization's technology strategy: efficiency and flexibility. These two factors have never been as important as they are today, as they highlight the fact that market trends are producing a degree of uncertainty that has not been seen before.

It is well known that in the traditional broadcast world, the marginal cost to the broadcaster to reach another viewer or listener is zero, as all of the distribution costs are fixed and sunk. In the online world the marginal cost both of converting content for new platforms,



FIGURE 1 MARKET COMPONENT MODEL

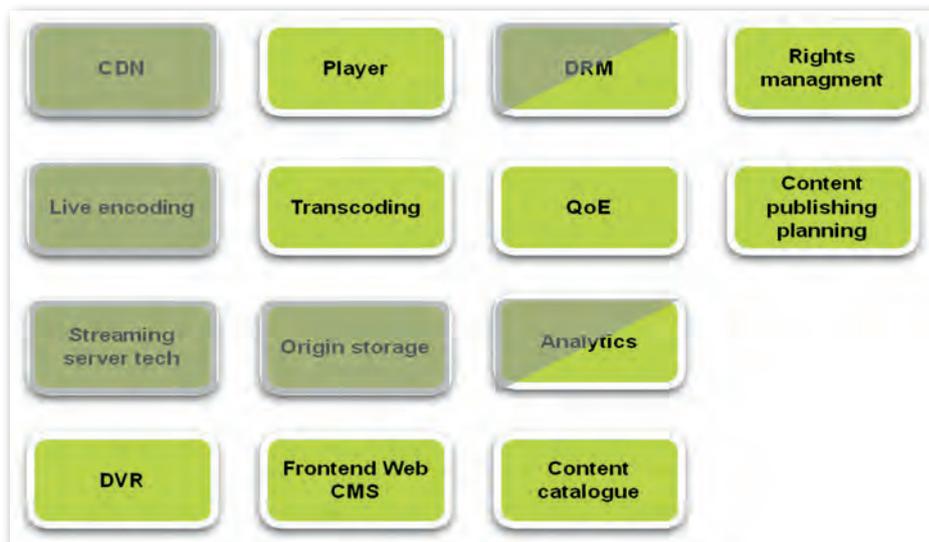


FIGURE 2 RESULTING OUTSOURCED PARTS (MARKED IN GREY) OF DR'S STREAMING OPERATIONS IN THE TENDER.

and then distributing that content is not zero. And the more successful the service, the higher the cost, as certain cost elements of internet distribution technology scale almost linearly with usage.

For public service broadcasters without advertising revenues this presents a challenge, as there may be an expectation from license fee payers to provide access to a broad range of content across all platforms in a multitude of formats, and there is no permissible mechanism to recover the additional cost. It is likely that technology and network costs will fall in the future and compression efficiency increase – for example through the use of HEVC – partially reducing the burden of increased traffic. It is however

equally likely that these developments will be compensated by audiences' rising expectations on quality and range of services as well as changes in audience behaviour.

TENDER PROCESS

DR had identified three specific areas which would be key to delivering a good streaming service in the future. They were used during the tender process for deriving functional and non-functional requirements and as a check list to ensure that the requested functionality and capabilities solved the problems DR was experiencing.

Scalability

One of the major concerns of DR was the

cost of scaling the streaming platform to the audience size and traffic volume that was expected in the near future. Looking to the strategy objectives of efficiency and flexibility, it therefore made sense for DR to procure a platform service where it had to pay for the distribution capacity only when needed, without requiring the up-front fixed infrastructure investment to meet future possible peaks.

Stability

It is common among many broadcasters that the non-linear services for delivery to web, mobile, tablets and connected TVs have grown organically and not necessarily with the operational organization and focus that you would expect to see in a more traditional broadcast service. When these services then become successful and start to attract viewers and generate significant traffic, the best effort approach to service availability and stability that had been employed starts to have a negative impact. Outages and problems are noticed by a larger audience and the user complaints start to grow.

Time to market

Linked to the strategic imperative for increased flexibility, DR was experiencing problems releasing new services and reaching new devices as quickly as both the organization and its audience would expect. It had for example proven hard to release services to new platforms; and the rapidly increasing number of platforms with ever-shorter release cycles by device manufacturers meant this problem would only intensify.

During the tender process the high-level market model (figure 1) was used to consider what to outsource and what to keep internal.

During winter and spring 2012/13 DR was working hard to prepare the tender. DR's streaming services had to a certain extent grown organically, so one of the big issues was to describe how DR's streaming services were actually functioning. Thereafter we were able to specify the tender based on the DR Technology Vision and specified areas for delivering a good streaming service. The tender was published on 5 June 2013.

Figure 2 shows the parts of the high level model that the streaming operations tender identified for outsourcing.

On 5 September 2013 we announced that Akamai had been chosen as the supplier, with the contract signed on 16 September. That same day Akamai took over the operation of the outsourced parts of DR's streaming operations.



Ferhat Uzaktaş



IN EACH ISSUE OF *TECH-I* WE ASK A MEMBER OF THE EBU TECHNICAL COMMITTEE TO STEP INTO THE SPOTLIGHT. THIS TIME IT'S THE TURN OF **FERHAT UZAKTAŞ**, DIRECTOR OF STUDIOS AND PROGRAMME TRANSMISSION SYSTEMS AT TURKEY'S TRT.

WHAT ARE YOUR CURRENT RESPONSIBILITIES AT VRT?

I have been working as manager at the Studios and Transmission Systems Department, where I am responsible for the purchase of all broadcast-related equipment and spare parts as required by TRT offices. I am also responsible for coordination between our various studios and managing the transfer of equipment as required.

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

I began my career as a studio engineer at the TRT Diyarbakır office in the southeast of Turkey. At that time a new production centre was being built and I played a central role in that project from start to finish. Some of the other important projects I've been involved with include the first HD television studio of TRT and the establishment of the TRT Türk TV channel, which is broadcast throughout the world.

WHY DID YOU STEP FORWARD AS A CANDIDATE FOR THE EBU TECHNICAL COMMITTEE?

I believe that the EBU is the most important organization in our broadcasting industry. I consider it an honour to play a role in the EBU

and to work together with the many experienced people on the Technical Committee. Coming from a country that is geographically on the periphery of the EBU membership, I can often bring an alternative perspective to discussions, which can prove useful.

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

EBU Members are public broadcasting companies. We are therefore limited by certain responsibilities with regard to the kind of programming we can broadcast. This sometimes results in lower ratings than achieved by commercial competitors. It is a challenge to find the optimal point where we can meet our responsibilities to create very good quality programmes while also maximising our viewership. It's a difficult challenge as audiences tend to prefer sensationalised programming.

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

I like to go on road trips with my family. I am interested in repairing all kinds of electrical and electronic equipment in my spare time. I also like to read historical books.

