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Published by the EBU
Technology & Innovation Department
17a, L'Ancienne-Route,
CH-1218 Le Grand-Saconnex
Switzerland.

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



The Value of Free

Lieven Vermaele

EBU Director of
Technology & Development

Having been involved with the development of public service media for many years, and in my current EBU role that involves driving and defending open and interoperable standards for the media industry, it remains an unending task to explain and demonstrate the value of 'free'. I have recently encountered two relevant cases in point.

During a session I produced for the EBU's General Assembly in Strasbourg during June, we heard some interesting statistics from Ben Keen of IHS. In examining the total economic value of the media and entertainment industry, he highlighted a striking figure. Tables showing the total money spent on entertainment content (covering packaged media, subscriptions, on-demand, etc.) illustrated that three times more is spent in the USA than in Europe. A threefold difference is enormous. Why would this be the case? We know that media consumption is higher in the USA than in Europe, but not by a factor of three.

One key difference between the Europe and the USA, that we can address, is the European model of a popular and (almost) free Public Service Media (PSM) organizations. A PSM organization can distribute its content via licensed spectrum and (free-to-air) terrestrial networks, or can fall back on 'must carry' regulations for cable distribution. I suspect that, because of these elements, European media markets are forced to keep their prices lower, both in content and in distribution. One outcome is that media are very accessible to all citizens. The value of free is there, but it's not always reflected in the bottom line.

In our discussions on net neutrality, we understand that broadband networks have their costs and that media usage is a big factor. When it comes to spectrum discussions we don't underestimate the value of broadband wireless and mobile networks. However, we need to be vigilant

to ensure that the digital dividend doesn't lead to a digital deficit for society as a whole.

My second recent encounter with the value of free was with the Open Source community. At the start of July we lent our support to the Libre Software Meeting in Geneva. For six days the (self-named) geeks of the world gathered to exchange and develop their software tools and ideas. As the EBU we organized a specific track around Free and Open Source Software for media. (See page 6)

It was amazing to learn about the free and open media tools that already exist in these (mostly) online communities: a complete play-out system, video and graphics mixers, loudness meters, software based radio, video encoding, etc. Projects like FFmpeg and VideoLAN (origin of the VLC player) provide key components for our industry to apply. Their origin is free but the economic value can be created in developing and commercializing products and offering support.

The EBU supports the transparent process of standards development, leading to open standards and the development of competing commercial products. Our industry needs open and interoperable standards, which we've achieved by fostering or contributing to industry forums. But, as is sometimes the case with industry forums, these Open Source communities aren't always that easy to access and understand. Nonetheless, in the coming world that's less focused on hardware and more oriented towards software platforms, the methods and outputs of the Free and Open Source Software movement will influence us. We should take note and cooperate with them.

The event in Geneva embraced the free spirit. They even produced open source beer, with ingredients and instructions openly published for anyone to vary or improve upon. The beer itself was not free-of-charge – but the recipe was. And that is the value of free.

ABU TECHNICAL REVIEW

250 AND STILL GOING STRONG

The EBU's sister union, the Asia Pacific Broadcasting Union, recently published the 250th issue of its technical journal, the the ABU Technical Review, writes David Wood. It first came out in 1969, the year Neil Armstrong set foot of the moon, and has been documenting key developments in broadcasting ever since. The editor of the first Review was Mr V. Barasubramaniam, Assistant to the ABU Secretary General, Charles Moses.

The very first article was about night-time transmitting aerials for tropical broadcasting by All India Radio.

A further article was by the BBC about Electronic Television Standards Conversion. The challenges of TV standards conversion were exactly the same then as they are today – changing the number of lines and images per second with the minimum quality loss. In those days it wasn't done with digital storage, but by using huge quartz crystal blocks which served as 'delays' for analogue TV lines and images, which could be added together. Are these blocks serving as giant bookends somewhere still?

Another early feature was 'Question Box', where ABU Members could ask for solutions to technical problems. The ABU also has its own study groups, and the hot ones mentioned in 1969 were on videotape recording and international programme exchange.

Over time the ABU Technical Review has changed its format and style but remains true to its mandate to reflect the ABU members' technology to the outside world, and the technology of the outside world to its members. The EBU offers its congratulations to Sharad Sadhu, ABU Technical Director and all the team at the ABU headquarters in Kuala Lumpur, Malaysia. Keep up the good work!

250th ABU Technical Review: tinyurl.com/abutr250

EBU Technical Review: tech.ebu.ch/techreview

NEW EBU TECHNICAL COMMITTEE 2012-2014

(L-R) Igor Orlov (RTR), Egon Verharen (NPO), Per Bjorkman (SVT), Thomas Saner (SRG SSR), Klaus Illgner (IRT), Kazimir Bacic (HRT), Arild Hellgren (NRK), Dieter Boen (VRT), Lieven Vermaele (EBU Director of Technology & Innovation), Petr Vitek (CT), Andy Bower (BBC), Gino Alberico (RAI), Ferhat Uzaktas (TRT). Not pictured: Pere Vila Fumas (RTVE).

NETWORK TECHNOLOGY SEMINAR 2012

ROUNDING UP THE RENDEZVOUS

The 2012 EBU Network Technology Seminar was described as "The Media & IT rendezvous", capturing the importance of the event as an annual get-together for the hybrid specialists in broadcast media production over IP networks and IT infrastructure. A straw poll taken during the event indicated that it had been successful in attracting people from both sides of the fence, although there were perhaps too few IT experts from EBU Members represented. Perhaps this reflects the fact that the EBU's technical department has traditionally communicated with the broadcast engineering community and needs now to reach out more to these new audiences?

A packed programme of use cases, technology updates and tutorials was well received by the 100 or so delegates in attendance. Most presentations generated a number of questions from the floor and stimulated lively discussions during the

networking periods. Presentations that seemed to strike a particular chord included Geoff Woolf's introduction of ViLoR, the BBC's technology for virtualized local radio, and the presentation by Matthias Laabs of the IRT on switching SDI in IP. The session on the use of consumer devices in broadcast was also well received, as was John Zubrzycki's opening keynote explaining how the BBC, together with NHK, planned to cover the Olympic Games in UHDTV. All three of the tutorials offered were well-attended, as was the interactive session moderated by the EBU's Hans Hoffmann. That discussion, which addressed the question of how IT and media will coexist in broadcast organizations, opened valuable non-technical perspectives on convergence issues.

EBU Members can access videos of all of the presentations given at NTS 2012 (tech.ebu.ch/nts2012); next year's event will take place on 18-19 June.



PANEL DISCUSSION ON EMERGING TECHNOLOGIES AT NTS 2012: MARKUS BERG (IRT), JOHN FLETCHER (BBC), MATTHIAS LAABS (IRT), FRANK BROCKNERS (CISCO).



FAREWELLS AND WELCOMES



Dr Alberto Morello stepped down as chair of the Technical Committee at the EBU Technical Assembly in Zagreb in June. He had been a member of the committee since 2000, when he was first appointed Director of the RAI Research and Innovation Centre in Turin. He had been TC Chair for the last four years, and for four years before that he was vice-chair. TA delegates elected Arild Hellgren of NRK as his successor, with Dr Klaus Illgner (IRT) and Andy Bower (BBC) filling the Vice-Chair positions. We wish all of them the best for the future and in particular we thank Alberto for his dedicated chairmanship and his valuable contributions over the years.

You're invited...
...to join us for drinks, snacks and conversation on the EBU booth at IBC 2012. Come along on Monday 10 September @ 17:00.

EBU @ IBC 2012

At IBC 2012 we can be found in our usual spot in the corner of Hall 10, where the focus this year is on meeting with our Members, promoting the activities we foster on their behalf, and acting as a guide and reference to the latest technology trends. Presentations will take place on the booth every 30 minutes, covering a wide range of topics. Demonstrations will include 4k UHD TV, MPEG-DASH, FIMS, recent Hybrid Radio developments, potential issues with the use of LED lighting, and new technology for RF HD cameras from the BBC.

On Monday evening at IBC, all EBU Members and group participants are invited to join us on the booth for drinks and snacks. There won't be a formal programme for this event – just an opportunity to meet with your fellow broadcasters and discuss all you've seen and heard at the show.

The EBU has a strong presence at the IBC Conference this year also. On Saturday afternoon we are producing a session titled "Prepare Today, Prosper Tomorrow: future-proofing for broadcasters". Leading

experts will focus first on the things broadcasters should be looking at in the short-to-medium term, and later on the longer term future. On Monday morning the EBU will present The Loudness Breakfast, a free

session providing the latest updates on R 128 implementation. Lieven Vermaele will speak at the Future of Broadcast TV

session and at a DigITAG session on spectrum policy, while Yvonne

Thomas will present a paper on quality issues around stereoscopic 3D.



IBC 2012

6-11 SEPTEMBER, AMSTERDAM

As usual the EBU will be present at Europe's largest broadcast media convention. Along with demos and presentations on the EBU booth (10.F20), a conference session on Saturday afternoon will provide advice on how to "Prepare Today, Prosper Tomorrow".

<http://tech.ebu.ch/ibc2012>



Quality Control Workshop

7-8 NOVEMBER, GENEVA

A free workshop on file-based Quality Control, presenting an excellent opportunity to actively share QC experiences with broadcasters and product implementers. Attendance is open to all.

<http://tech.ebu.ch/qc12>



Forecast 2012

14-15 NOVEMBER, GENEVA

Organized by broadcasters for broadcasters, Forecast is a unique opportunity to find out about the latest trends in spectrum management and broadcast delivery and discuss common problems and their solutions.

<http://tech.ebu.ch/forecast12>



Media Production as a Service?

20-21 NOVEMBER, GENEVA

A workshop that aims to demystify cloud technologies for broadcasters, with a particular focus on media production tools.

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



IMPS Seminar

10-11 DECEMBER, GENEVA

At this event we will present and discuss the findings of the EBU Strategic Programme on Integrated Media Production Strategies.

<http://tech.ebu.ch/imps2012>

Looking further ahead...

Production Technology Seminar 2013
29-31 January

BroadThinking 2013
27-28 March

Digital Radio Summit 2013
13 February

Network Technology Seminar 2013
18-19 June

LIBRE SOFTWARE MEETING 2012



TUX THE LINUX PENGUIN KEPT A WATCHFUL EYE ON PROCEEDINGS

INTO THE GREAT WIDE OPEN

The use of Free and Open Source software (FOSS) for professional media is becoming an increasingly viable option. Several examples of products that are already in use by broadcasters were presented at an event in Geneva during July. RMLL – Rencontres Mondiales du Logiciel Libre – is an annual conference, exhibition and festival dedicated to discussing and promoting FOSS. Also known as the Libre Software Meeting, it's an event that embodies the spirit of its subject matter, providing a very open and relaxed atmosphere for discussing and exploring a wide range of application areas.

The EBU took advantage of the fact that RMLL 2012 was hosted in Geneva to coordinate some activities around the use of FOSS for radio and television. Two full days of presentations were organized, along with hands-on workshops and demonstrations



and a visit to the local facilities of EBU Member RTS. Among the most interesting products presented during the media sessions were CasparCG for professional graphics and video play-out, Airtime software for radio station management, and Blender for 3D content creation.

Those attending the EBU sessions expressed a belief that the EBU can play a role in allowing broadcasters to take advantage of the benefits of an FOSS approach. The priorities should be to make sure that technical specifications are openly accessible and to enable the sharing of practical Members' experience. Another may be to unite EBU Members toward specific technical problems being solved in open software, which can then be used by each of the individual Members as fits them best. It seems certain that this is a topic that will attract more and more attention from the EBU's technology community in future.

MDN WORKSHOP

MAKING THE MOST OF METADATA

Leading metadata experts gathered at the EBU in June, writes Jean-Pierre Evain, for a hands-on workshop of the EBU Metadata Developer Network, the second such event to be held. Several important aspects of metadata were addressed.

Limecraft presented the initial version of an open source MXF Software Development Kit supporting EBUCore metadata as it is being registered in SMPTE. This tool, developed with and sponsored by the EBU, is essential for our metadata community. The Joanneum Research Institute introduced the MPEG-7 Audiovisual Description Profile (AVDP), now an ISO standard, initiated within a project of the EBU's Media Information Management programme. The AVDP provides a standard representation for the publication of results from automatic information extraction tools for audiovisual content. Such tools are destined to be integrated in Service Oriented Architectures such as that being standardized by the EBU-AMWA FIMS project.

The Fraunhofer Heinrich Hertz Institute explained recent developments in the automatic assignment of keywords to videos, to replace inaccurate and tedious manual keyword assignment and enable more effective search in video collections.

The National Technical University of Athens (NTUA) presented the EBUCore mapping and metadata aggregation tool. The tool, developed in collaboration with and sponsored by EBU, has been designed to help users map their metadata schemas to EBUCore. It provides a head on XML transformation. Future developments will include the transformation in EBUCore RDF (Resource Description Framework).

RAI described an Apache OpenNLP (Natural Language Processing) library for extracting meaningful information from textual or textualized data streams, based on sentence detection, tokenization, POS (Part-of-Speech) tagging and named entities detection. Training tools are provided to users for building their own language models, thus making the library open and extensible.

Finally, the EBU presented the EBU Class Conceptual Data Model (CCDM) and associated ontology. The model has been designed as a basic framework to be extended and customized by users with different needs, from commissioning to distribution. Extensions can be made using RDF/OWL parsing/editing tools, or more simply from the Excel representation of the model. The workshop was very successful and another similar event is already scheduled for 2013 over two days, with longer sessions for an even more immersive hands-on experience.

COMMON BROADBAND VIDEO PLATFORM

STREAMING THE GAMES

As this issue of *tech-i* went to print, viewers across Europe were discovering the EBU's Common Broadband Video Platform (CBP), with its unparalleled free-to-air live video coverage of the London 2012 Olympics. Throughout the event, the CBP provided simulcasts of EBU Members' Olympic output, complemented with dedicated live feeds directly from London.

In total there were more than 40 live streams on the platform, representing 8,000 hours of live coverage. CBP streams are delivered using RTMP Flash and adaptive HTTP Flash with H.264 video coding. Live pause functionality allows viewers to pause and rewind the live action. During the Olympics the CBP was delivering an average of two million live streams per day to viewers based in countries covered by the EBU's rights agreement with the IOC (International Olympic Committee). Geographic controls and streaming security were used to ensure adherence to the agreement.

An archive of 1,600 hours of the Games will be made available on an ongoing basis. Visit: www.eurovisionssports.tv/london2012





DURING THE RECENT EBU TECHNICAL ASSEMBLY IN ZAGREB, DR ALBERTO MORELLO OF RAI STEPPED DOWN AS CHAIRMAN OF THE TECHNICAL COMMITTEE AND NRK'S ARILD HELLGREN WAS ELECTED AS HIS SUCCESSOR. IN THIS ARTICLE THEY TAKE A LOOK BACK AT THE EVENT.

Assembling in Zagreb

The positive atmosphere among delegates, the feedback received afterwards and the impressive job done by our hosts HRT all add up to what ranks as one of the most successful Technical Assemblies. Throughout our stay in Zagreb there was a real sense of colleagues openly sharing their experiences and exploring possible solutions to the many challenges we face as public service broadcasters.

This was particularly exemplified by the keynote session, featuring a highly relevant and timely speech from Pearse O'Donohue, the European Commission's Head of Spectrum Policy. He set out the options being considered for the future use of the 700 MHz band and provided his insight into how the mobile network operators are positioned in this process.

The breakout discussions that followed gave delegates an opportunity to tease out some of the issues at stake and a lively Q&A session with Mr. O'Donohue probably left him in no doubt as to the depth of concern among broadcasters.

In response to the feedback received after previous TAs, the programme this year was designed to focus on matters of strategic importance for the Technical Directors of EBU Members.

Thus, on the afternoon of both days a Strategic Focus session took place, the first looking at An All-IP Approach for Public Service Media and the second focusing on Future Media Consumption Scenarios. Both sessions were well received, with the presentations generating a lot of interesting questions. To mention just a few particular points that came up:

- Herbert Tillmann (BR) introduced the new Integrated Media Production Strategies programme and reported



EC HEAD OF SPECTRUM POLICY PEARSE O'DONOHUE IN CONVERSATION WITH LIEVEN VERMAELE

on some of its very early findings. It's clear that file-based production requires large investment, with the hope of reducing the on-going costs; but as public broadcasters are often limited in their ability to reduce headcount, the advantage is more likely to be in increased output (multichannel TV, radio and online), rather than in cost reduction. Training of staff in new IT-based techniques will be ever more important.

- An informative presentation on Content Delivery Networks (CDNs) from Egon Verharen (NPO) shone some light on what is a new area for many EBU Members, who are traditionally oriented towards running broadcast networks. Given the key role of companies that we don't control (CDN operators, Internet Service Providers, Telcos, etc.), we will require a creative approach to find new win-win business models.
- The BBC's Andy Quested looked into the future and wondered whether 4k UHD TV would be a sufficient step, suggesting that perhaps 8k could

be more attractive in the long term. Subsequent discussions in other forums have suggested that not all stakeholders share this vision.

These are just three of the many topics that we could mention here. There was a lot more great content provided for delegates, not least the Proud to Present session that brought us from Germany to Belgium, via Sweden, Poland and the UK: five short but interesting presentations on some recent Member projects.

David Wood presided over a wide-ranging discussion panel that, through no fault of those involved, never quite caught fire: perhaps the delegates were still (understandably) distracted by what turned out to be a reasonably complicated election process. Nevertheless, some interesting points were raised thanks to David's typically entertaining hypothetical situations.

The social programme organized by our host Kazimir Bacic and his colleagues at HRT was greatly appreciated. The EBU's Director General, Ingrid Deltenre, and HRT Chairman Josip Popic both attended the Welcome Reception, which took place on the 17th floor of the Westin Zagreb Hotel (as did the TA itself), providing a stunning panorama over that fine city. The food served throughout the event was always impressive, and we received the warmest of welcomes on our visit to the HRT studio facilities. Finally, many of us were fortunate to be able to remain on in Croatia for a visit to the unique Plitvice Lakes National Park.

All in all it was an excellent Technical Assembly. Our thanks to the teams at HRT and at the EBU for their faultless organization; and to the more than 110 delegates whose active participation is so essential for our work to succeed.

KAMERAWERK STEREOGRAPHER CHRISTIAN WITSCHI ADJUSTING THE 3D RIG



The Turin Shoot

DURING JUNE 2012, THE EBU'S BEYOND HD AND 3DTV PROJECT GROUPS WERE IN TURIN TO CREATE NEW REFERENCE VIDEO TEST SEQUENCES IN UHDTV AND 3DTV. THE STORY IS TOLD BY HANS HOFFMANN, ADI KOUADIO AND YVONNE THOMAS OF THE EBU, WITH MASSIMO VISCA OF RAI.

What comes after HDTV? The consumer and professional industries are putting considerable effort into promoting next generation TV formats. They hope to take advantage of the fact that viewers have been exposed to much more 3D content, primarily in cinemas, and are becoming aware of the possibility of Ultra High Definition TV (UHDTV). While EBU Members are very much focused on implementing their HD strategies, they also recognize that the window of opportunity to set interoperable standards and influence industry developments for the next generation of TV formats is now open.

This was the key driver behind the creation of a new set of test sequences.

From 11-22 June this year, the Beyond HD Project Group (chaired by Massimo Visca of RAI) and the 3DTV Project Group (chaired by Andy Qusted of BBC), undertook the task of creating what are certain to become landmark video test sequences. The test sequences were shot in the 4k format (4096x2160 pixels*, 16 bit) at 50 frames per second, while for stereoscopic 3D the format was 1080p/50 per eye, including a higher frame rate of 120 frames per second. The shoots took place at the RAI Production Centre in Turin, and involved close cooperation between the RAI Research Centre, the

RAI Production Centre, EBU Members, industry representatives, and the EBU Technology & Innovation Department.

WHY NEW SEQUENCES?

To develop a deeper technical understanding of the visual advantages of the new formats over HDTV, and to facilitate scientific investigations on, for example, next generation video codecs like HEVC (High Efficiency Video Coding), it was important to create test content that remains rights free. Such content should also comply to the criteria outlined in the ITU-R BT.500 recommendation (in the case of non-3D content). Thus the sequences should represent various genres and should be critical, but not unduly so; i.e. they should feature content and action that is sufficiently complex to rigorously test the full production chain, but could still be considered as typical broadcast material. As a library of such content did not already exist, the EBU groups undertook the task of creating one for the benefit of the wider community.

For the 4k test sequences Sony supplied an F65 camera running at 50 frames per second. The Sony F65RAW format (16 bit, with S-Log2 colour space) was transferred to DVS servers. The selection of good/bad shots, and the final post-production of the raw format and colour-space conversion to Rec709, was conducted by Quantel.

The decision on which 3D format to shoot was based on the recent publication by the DVB Project of their Phase 2a specification (Frame Compatible Plano-Stereoscopic 3DTV) and the fact that they are finalizing the Phase 2b "Service Compatible" specification, which provides for full resolution per eye. With support from ARRI, the clips were shot using two Alexa M cameras in the ARRI RAW format at the full sensor resolution (2880x1620 pixel, 12 bit). The cameras, which feature a separate camera head and body, were mounted on a P&S TECHNIK Freestyle (Mirror) Rig. Later, in post production, the resolution will be downscaled to 1080p/50 and the parallax will be optimized for each scene via the Horizontal Image Translation value.

DELIBERATE ERRORS

For some of the 3D sequences, the parameters were changed to create a deliberately "stressful" experience,

CLOCKWISE FROM TOP: RICHARD SALMON (BBC R&D), HANS HOFFMANN (EBU) AND DANIELE AIROLA (RAI RESEARCH) EXAMINING THE 4K RUSHES; CRITICAL SEQUENCES ARE ESSENTIAL FOR TEST PURPOSES; THE SONY F65 CAMERA USED FOR THE 4K SHOOT

BELOW: ARRI ALEXA M CAMERAS WERE USED FOR THE 3D SEQUENCES

as opposed to the “comfortable” 3D set-up that we would normally target. Such sequences can be used in future for training and education purposes. Some of the parameters that were changed included: convergence/divergence; different (de-)focus per camera; several rig height positions; extreme negative parallax; with/without Quarter Wave Filter for reflections; incorrect roll; and incorrect tilt. Sequences of many kinds were shot, including indoor and outdoor, still and with movement, pans, tilts, natural textures, skin tones, etc.

In addition to 3D 1080p/50, the cameras were also set to 100/120 Hz frame rates to generate experimental content for high frame rate 3DTV tests that the EBU will conduct in future.

WHAT COMES NEXT?

At the time of writing, the Beyond HD project is continuing the process of selecting a set of sequences for further testing of the formats. In particular, the 4k tests will concern studio compression formats and the HEVC codec for distribution to the home. For 3D, tests will be conducted on the codecs and formats specified by DVB. A number of the Turin sequences will be shown at IBC 2012 on the EBU booth (10.F20), with support from the HEVC coding experts at Fraunhofer HHI.

In the past, the EBU has generally made such test sequences freely available to foster research and innovation within the whole broadcast community. EBU Members and the partners that have actively contributed to the generation of the sequences will therefore have access to all sequences for scientific, non-commercial tests. Other parties are invited to contact the EBU for the conditions attached to obtaining the test sequences.

The availability of high quality and rights free reference test sequences is a prerequisite for further scientific tests on the technologies that lie beyond HTDV. The library of 4k and 3D content to be made available to EBU Members after IBC will support many further activities related to the definition of future TV formats.

*For more information and to view some samples visit: tech.ebu.ch/testsequences
* See EBU TR014 on terminology for 4k and UHD TV.*



PARTNERSHIP IN ACTION

This project could not have been undertaken without the support of several industry partners and EBU Members. The 4k and 3D shoots were managed as two separate sub-projects. For the 4k production the following partners were involved:

- Sony provided the SONY F65 camera including all accessories, memory and software
- DVS provided a Clipster server with F65RAW support
- Astro Design provided two 4k screens
- TVLogic provided a 4k screen
- CW-Sonderoptic provided a set of Leica Summilux Prime Lenses
- Quantel provided two edit suits with their Pablo system for post-production

For the 3D production the following partners were involved:

- Kamerawerk, hired to provide a team consisting of a Stereographer, Stereo Supervisor and Editor, as well as the 3D Rig and other equipment for both the production period and follow-up with post-production
- ARRI provided two ARRI Alexa M cameras including recorders and accessories like lenses and memory
- Technicolor provided their Certifi3D for the Quality Control
- Sivel Technology provided some funding for the shoot
- TVLogic provided two 3D screens
- Quantel provided a 3D editing cinema room for post-production.

Particular thanks are due to the RAI broadcasting organization, which provided a studio, logistics support and personnel such as a Director of Photography, Operator, etc., at their Production Centre in Turin. Colleagues in the RAI Research Centre also provided valuable support. Experts from several other EBU Members, including BBC and IRT, were also present to support the shoots.



Productivity Personified

FORMER EBU TECHNICAL DIRECTOR PHIL LAVEN MARKS THE RECENT RETIREMENT OF DAVID WOOD



David Wood retired at the end of June 2012 from the post of Deputy Director of EBU Technology & Development. He joined the EBU in August 1980, having previously worked in the UK for the BBC and for the Independent Broadcasting Authority (IBA).

At the EBU, David soon became an internationally-recognized authority on broadcasting technologies, commanding respect for the depth of his knowledge on a very wide range of subjects. His encyclopaedic knowledge was incredibly useful at many EBU meetings, such as the EBU Technical Committee, where he could be relied upon to deliver concise summaries of why a particular topic deserved the EBU's attention and also explain the many reasons why it might prove difficult to get universal agreement on a way forward!

For many years, David has been deeply involved with "new technologies". It would be impossible to list all of these technologies – but one of his earliest successes was in helping to persuade the ITU to adopt a global production standard for digital TV. Although this was eventually achieved in 1982, the resulting standard (now known as ITU-R Recommendation 601) is still widely used.

Attendees at innumerable conferences have enjoyed his quirky and amusing



presentations that, most importantly, often contain some startling insights into the applications of technology.

Although David is, first and foremost, an engineer, he has passionately advocated that broadcasters must embrace the potential of digital technologies if they are to remain relevant to their audiences. As Secretary to the EBU Digital Strategy Group (chaired by Christian Nissen, former Director-General of Danmarks Radio), David was a major contributor to the report "Media with a purpose: Public Service Broadcasting in the digital era" published in 2002. Much of that report remains valid 10 years later, but David has been working with the EBU's second Digital Strategy Group on a follow-up report.

Outside the EBU, many other organizations (e.g. the ITU, European

LEFT: AT IBC 2006 - DAVID WOOD HAS A RARE TALENT FOR MAKING TECHNICAL SUBJECTS UNDERSTANDABLE AND ENGAGING

BELOW: DAVID WOOD IN ACTION AT AN ITU/CCIR MEETING IN 1981 – EXPLAINING THE MERITS OF THE PROPOSED 4:2:2 STANDARD FOR DIGITAL TV PRODUCTION, SUBSEQUENTLY ADOPTED AS ITU-R RECOMMENDATION 601

Commission, WBU, SMPTE, IBC, DVB, DigiTAG, FAME, etc.) have benefited from his fertile mind and his amazing capacity for hard work. He has always been keen to assist others. He would often say something like "they really need some help – and, as nobody volunteered, I offered". For example, he has always insisted that the EBU should work actively with its sister Broadcasting Unions around the world, especially through the Inter-Union Technical Committee – now known as the World Broadcasting Unions' Technical Committee (WBU-TC), of which David is the current Chairman.

David has long been actively involved in organizing the EBU's technical activities. In overseeing the work of engineers in the EBU Technical Department, he has been a tower of strength giving generous support and advice to his colleagues.

Having worked closely with David for many years, I can say that, without any doubt, that he is the most productive person that I have ever met. His ability to produce finely-crafted documents at short notice is legendary – as is his willingness to accept difficult tasks and, sometimes, even "impossible" tasks.

Many readers will have seen David carrying various odd-looking film cameras equipped with two side-by-side lenses. Of course, this long-term interest in stereoscopic photography is proof that he was well ahead of the current fashion for 3D. It is only fitting that, over the past couple of years, David has been a leading player in DVB's standardization work on 3DTV.

On behalf of the EBU and its Members, I would like to take this opportunity to thank David for his outstanding contribution to the work of the EBU over a period of more than 30 years and, perhaps more importantly, to acknowledge that his work has benefited broadcasting as a whole. His dedication and professionalism are, in my opinion, unrivalled.

RTÉ - Raidió Teilifís Éireann

WE TRAVEL TO IRELAND FOR THIS ISSUE'S MEMBER PROFILE, WITH RTÉ'S HEAD OF TELEVISION TECHNOLOGY, **PAT FENTON**, PROVIDING AN OVERVIEW OF SOME OF THE BROADCASTER'S TECHNOLOGY MILESTONES AND RECENT INNOVATIONS.

Broadcasting in Ireland started in 1926, just after the country gained its independence, with the opening of the first radio station 2RN by the then President of Ireland, Dr Douglas Hyde. It used a single high powered 60 kW transmitter. In 1937 Raidió Éireann was launched as the country's national radio service. In 1960 the new television service was launched and RTÉ (Raidió Teilifís Éireann) was founded, supported by a licence fee of £4, introduced to fund the service.

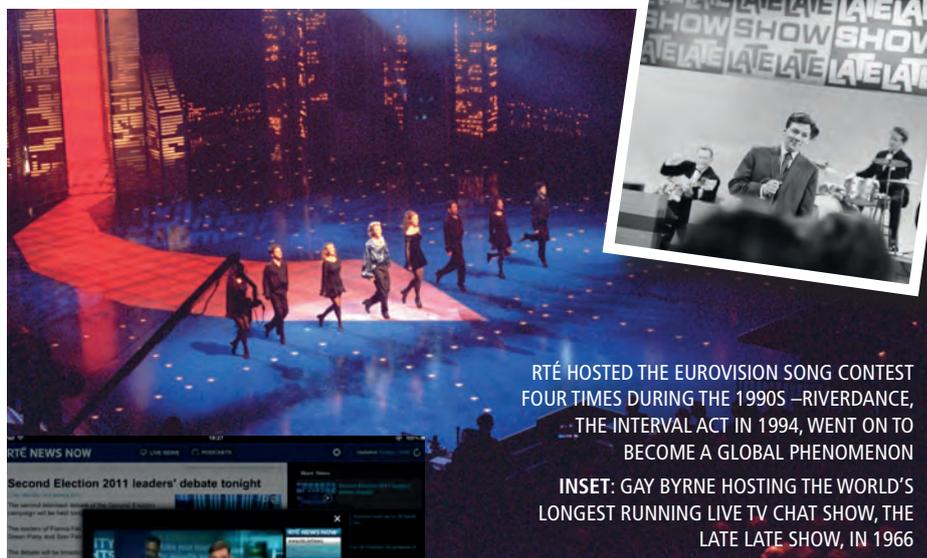
For the first fifty years or so Irish national radio was confined to a single channel. Change began in the 1970s with the introduction of FM transmissions, first with the foundation of an Irish language station in 1972 (Raidió na Gaeltachta) and later with the introduction of a popular music service (2FM) at the end of the decade. In 1999 classical music received its own channel (Lyric FM), and now, in 2012, these four FM services are complemented by a further six digital services from RTÉ. RTÉ's radio stations are available online, on DTT, satellite, cable, and also on a trial DAB service, which currently covers about 60% of the population of 4m people.

Meanwhile, digital production in radio was introduced in the 1980s and, although analogue tape was in use in RTÉ Radio as late as 2003, most radio output had migrated to full digital production by 1999. Taken together, the combination of new services and new digital production methods has meant a huge increase in radio output over the last two decades.

TV ARRIVES

In television, 1962 saw the first broadcast of the longest running live TV chat show in the world, The Late Late Show. A second national TV channel, RTÉ Two, was launched in 1978. In the 1990s RTÉ hosted the Eurovision Song Contest on four occasions in five years.

RTÉ Television and News began the transition to digital in the 1990s with the introduction of a new SD infrastructure and of Digital Betacam as the station standard for programme acquisition, production and archive. A major project was undertaken to restore old archive material from film, 1" and 2" tape to Digital Betacam. The visual archive holds over 250,000 hours of material. A major



THE RTÉ NEWS NOW APP ON THE IPAD

challenge exists to fully digitize this archive and make it available to the public.

In recent years the task of replacing the SD environment with HD-SDI infrastructure has been ongoing. The first HD transmission on RTÉ Two HD was on 28 May 2011. This year the EURO 2012 tournament and the London Olympics are being produced in HD from a revamped Studio 5 in RTÉ's Television Centre.

FILE-BASED WORKFLOW

RTÉ Television and News has also introduced a fully file-based workflow from acquisition to broadcast. Avid Interplay is used for production, and self-editing by journalists and producers is widespread. New channels have been developed such as a 24-hour news channel (News Now) and playout is currently being revamped to implement an end-to-end file-based SD/HD environment.

In 1998 the RTÉ.ie website was launched. This began an exciting series of developments to place content on non-traditional platforms. Live streaming was introduced in 2006, initially to carry important sports and public events, and since then has expanded to include a wide range of content. In 2009 the RTÉ Player

was launched, providing a 21-day catch up service for RTÉ programmes, with an international version of the Player made available the following year. The RTÉ Radio Player was launched in 2011, and more recently a number of apps have been developed for smartphones and connected TVs. The growth in IP traffic has been very significant with over 120 million page impressions per month currently served across all online and mobile services, and over 8 million stream plays.

TRANSMISSION

In transmission, RTÉNL, a fully owned subsidiary of RTÉ, provides free-to-air terrestrial transmission services. SAORVIEW is the DTT platform in Ireland, with currently one multiplex carrying both SD and HD channels. It is planned to light up a second multiplex in 2013 when additional services are to be made available on the platform. There is also a satellite solution, SAORSAT, using the Ka band to cover the 2% of the population who cannot receive DTT. Analogue switch-off will be achieved on 24 October this year.

Like many EBU Members, RTÉ faces the huge challenge of delivering high quality content and a wider range of services to an increasing number of platforms, in difficult financial circumstances. But RTÉ has a history of rising to these challenges, and we have a long tradition of technical excellence which will help to ensure that we succeed.

Distributing the drama

THE SUMMER'S FIRST MAJOR SPORTING EVENT, EURO 2012, WAS ALSO A MAJOR SUCCESS FOR EUROVISION, WHICH WAS RESPONSIBLE FOR THE BROADCAST DISTRIBUTION. **MOSTAFA BIBAK**, SPECIAL EVENTS ORGANIZER WITH EUROVISION, PROVIDES AN OVERVIEW OF HOW IT ALL HAPPENED.

Spain's victory over Italy in the recent UEFA EURO 2012™ tournament also saw them become the first team in history to win three major international tournaments in a row. This sporting first was matched by technology firsts relating to the distribution of the tournament to broadcasters across the globe. Such major events are often key drivers for new technologies, and this was no exception, being the first tournament to be distributed in MPEG4.

EUROVISION, operated by the EBU, was UEFA's trusted partner to handle the huge challenge of transmitting HD and SD signals from 31 matches in eight stadiums spread across two large countries. The tournament was viewed by hundreds of millions of viewers around the world. EUROVISION's unparalleled experience in global audiovisual transmission means that it can guarantee the level of quality and service expected for a major sporting event like EURO 2012.

This year's tournament was hosted jointly by Poland and Ukraine, with the

opening match taking place in the Polish capital of Warsaw and the final taking place in Kyiv, the Ukrainian capital. There were four stadiums used in each country. The IBC – International Broadcast Centre, the media hub during major events – was located in Warsaw.

Each stadium was connected to the IBC by a fibre backbone of 30 Gbit/s, provided by UEFA's telecom partners for the event. EUROVISION provided live satellite distribution from the stadium to broadcasters worldwide during the matches, along with satellite backup links from each stadium to the IBC. During the group stages there were two matches each day in Poland, with two more in Ukraine the following day, and so on for 12 days.

At each stadium we deployed two antennas, with diameters of 4.5m and 2.4m respectively, as well as all encoding and modulation equipment. The antenna choices were made based on several link budget calculations and taking all necessary precautions to allow for worst case scenarios such as storms, heavy rain, etc. The electronics were housed in a

container located on the TV compound of each stadium. The installation in each case was operated by a pair of qualified engineers under the supervision of the IBC in Warsaw.

As the European distribution of each match required three satellite transponders of 36 MHz each, we were loading six transponders on a daily basis. The transponders were loaded directly from the venue, with a robust fibre backup allowing us to route the signal from our distant teleports in case of bad weather at the stadium. (The robustness of our set-up was put to the test by the torrential rain that hit Donetsk just before the Ukraine vs. France match. The redundancy built into the system stood up well to the challenge, with no interruption of service.) We also provided several other ancillary services to our client UEFA, requiring the fulltime availability of six additional 36 MHz transponders.

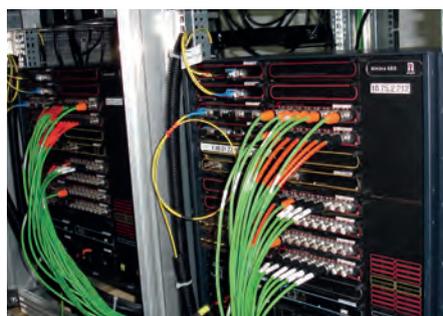
For the tournament final in Kyiv, we leased two additional 36 MHz transponders for the coverage of fan reactions, so in total, for European coverage of the final, we were using 11 transponders of 36 MHz over four satellites. In Asia and the Americas the signal was distributed in both HD and SD format. For the first time we used the DVB-S2 16APSK modulation scheme in these two regions. (In Europe we used 8PSK as usual.) For the HD signal we used two times 42 Mbit/s; for SD we used two times 21 Mbit/s.

The video coding format for the distribution HD signal was MPEG4 H.264 with a 4:2:2 profile. On request we distributed new compatible IRDs (Integrated Receiver Decoders) to TV broadcasters, as it was the first time that such a major event was distributed in MPEG4.

For several weeks before the event we made a reference carrier available to broadcasters, along with the necessary technical documentation and assistance. This allowed them to tune their installations and test the new equipment. All in all the event passed off smoothly, with no major technical problems and uninterrupted signals available to all UEFA Broadcast Partners around the world...which meant viewers were free to concentrate on the goals!



CLOCKWISE FROM ABOVE: EUROVISION'S MASTER CONTROL ROOM AT THE IBC IN WARSAW; MEDIA SWITCH ROUTERS FOR MANAGEMENT AND ROUTING OF THE FIBRE AND VIDEO CONTENT; MONITORING THE FEEDS FROM ONE OF THE GROUP MATCHES



Network Provider	Broadcaster
<p>You're through to the Help-desk. What can I do for you?</p> <p>Okay. Let me check the log... You're correct – there was momentary congestion on the network.</p> <p>Let me see, a single 10 second incident in one week... that's unavailability of 0.002%. That means your service has been available 99.998%. Your SLA stipulates 99.99%, so everything is in order. What is the problem?"</p> <p>Well I'm sorry, but we've fulfilled our contract with you. Goodbye!</p>	<p>Hi. We just had 10 seconds of black frame on air! This is catastrophic!</p> <p>Yes, at the EXACT MOMENT when the winning goal of the World Cup was scored!</p> <p>You can't be serious! Our viewers are going crazy on the social networks and our sponsors won't want to pay us!</p>

Not all SLAs are created equal

THE BBC'S YUAN-XING ZHENG, CHAIR OF THE SLA PROJECT GROUP AND FÉLIX POULIN, PROJECT COORDINATOR FROM THE EBU, EXPLAIN WHY SUCH AN INITIATIVE IS NECESSARY AND WHAT IT WILL DELIVER.



This rather extreme situation could have occurred if the broadcast media organization in question had agreed a Service Level Agreement (SLA) based on a conventional IT/Telco model. Our intention here is to illustrate that the specific needs of broadcast media organizations should be taken into account in the specification of SLAs.

With the rapid growth of IT infrastructure, and the ease and speed with which networks can be set up, more and more broadcast media organizations are considering the use of data networks for media transport, whether for the contribution of breaking news stories, coverage of major music or sporting events, or conducting interviews with guests in remote studios.

However, when it comes to the drafting of SLAs between media organizations and network service providers, we have found that both often lack important knowledge regarding special broadcaster requirements that may need to be specified. For instance, the time criticality of the stream and the high availability required for live prime time programming are not typically described in a standard SLA.

It is to address this need for knowledge that the EBU set up a working group on SLAs in October 2011. EBU Members participating in the project are providing the use cases that need to be addressed by a media-specific SLA. We have also realized that without the expertise of service providers and good cooperation with them, any recommendation from this group will have

only limited impact. This is why we have also recruited many participants from the network provider industry.

TWO DOCUMENTS

At the beginning of the project, and after thorough debate and careful consideration, we decided to produce two main documents. The first is a set of high level guidelines, intended to provide an overview of the components and principles that should be carefully considered when negotiating an SLA for media transport services. The target audience for this document is professionals from media organizations that either lead or contribute to SLA negotiations or have responsibility for signing off an SLA. Their counterparts in the network service providers will also appreciate knowing the expectations of broadcast media organizations. We intend to publish this high level SLA guidelines document before the end of this year; at the time of writing it is under peer review.

The second document is planned for the first half of 2013. It is the technical supplement to the guidelines. It will describe the recommended technical parameters to characterize the level of service. It will cover four different types of service that can be contracted from a provider: physical link, data link, network, and media transport. A recommendation on how to measure the performance will also be included.

If you wish to contribute to this important work, you can join the project at tech.ebu.ch/sla

WHAT IS AN SLA?

A Service Level Agreement forms part of a service contract where the level of service is formally defined. It is a negotiated agreement between two parties, the customer and the service provider. It defines in quantitative terms the service being offered to a customer, its quality level in technical parameters, and how these should be monitored and verified. How incidents are defined, reported and escalated, and how eventual penalties are calculated are also usually addressed in an SLA.

PARTICIPANTS AT THE FIRST MEETING OF THE SLA GROUP, OCTOBER 2011



The watercooler has gone digital

BRAM TULLEMANS, WHO COORDINATES THE EBU'S TECHNICAL ACTIVITIES AROUND BROADBAND DELIVERY AND TV PLATFORMS, COMPARES RECENT STATISTICS ON AUDIENCE USE OF MULTI-DEVICE, ON DEMAND SERVICES TO LIVE BROADCAST.

No, this is not a guide to digital techniques for cooling water at broadcast facilities during the summer months. The 'watercooler effect' refers to the habit of office workers gathering around the watercooler to discuss what they saw on television the night before. Some have claimed that the popularity of On Demand services will bring an end to the linear broadcast model, because the removal of the time component will dissolve the social binds of the watercooler effect. Here, for example, is Wired editor-in-chief, Chris Anderson, in his book *The Long Tail*: "Who wants to listen to the morning-after recaps of real-timers, people who will ruin the surprise of shows you've yet to watch?" In fact, comparing data gathered by the Dutch public broadcast organization, NPO, we can conclude that this is not true.

The audience uses On Demand services differently on different devices to catch up on what they did not see live. And social media sites are more and more becoming the place where broadcast TV shows are discussed. The watercooler effect has not been diminished, but it has been (partly) digitized.

NO DECLINE IN LIVE

NPO's online catch-up service, Uitzending Gemist, has been a full blown service since 2003. Almost a decade later there has been no decline in the audience watching linear television. The growth market today is in online services, with mobile devices leading current demand. If we compare On Demand platforms with linear broadcast for NPO, almost 3% of viewers of any given programme are watching on demand. Almost half of these on demand views are generated by the PVR and set-top box in the home. The vast majority of all views are still live broadcast. But looking more closely at audience behaviour on different distribution platforms we can conclude that they perform an essential function that reinforces audience participation and the social binding factor that is so important



for public broadcasters.

Almost half of on demand views are generated within 24 hours after the broadcast. Live broadcast creates the agenda for on demand use. Looking deeper into the statistics regarding how live broadcast programmes are subsequently watched on PVRs and online catch-up services, we notice platform-specific audience behaviour in choice of content, attention span and the time of day that a specific device is used.

DEVICE DIFFERENCES

While the popularity of specific content on specific devices is partly attributable to the fact that mobile services attract younger people, the NPO figures also show that, for example, drama is more popular on their PC-optimized website than on other devices, while on their HbbTV service news and drama together gain most attention. Audiences tend to watch a narrower range of content via mobile-

optimized platforms than on PC-optimized websites. This is to be expected given the fact that the smaller screens of mobile devices aren't well suited to browsing big catalogues.

The bias towards browsing on services optimized for PCs and laptops is also evident when examining attention spans for different devices. Programmes are watched for short lengths of time on the NPO's catch-up service optimized for PC use. It's generally used to browse quickly through content, while on mobile devices programmes are watched on average for longer periods. Programmes recorded in the home or watched on demand via the set-top box are viewed almost from beginning to end, which is even longer than for live broadcast TV. The difference in attention span seems, therefore, not to be related directly to the size of the screen.

AT THE END OF THE DAY

The devices used to access NPO content also vary depending on time of day (Fig. 1). All media consumption peaks in the evening, but for mobile devices the peak is late night into early morning, when users catch up with what has been broadcast. Compared to apps, mobile-optimized websites are accessed early in the day and also peak at the same time as linear broadcast. Players on PC-optimized websites don't peak significantly at a particular time, but are used to access content throughout the day. The HbbTV service is also used throughout the day (more so than linear TV), but peaks clearly in the evening. Reflecting the hybrid nature of the HbbTV service, its curve approximates a merging of the curves for PC-optimized websites and PVRs.

So, we can see a strong relationship between live broadcast and On Demand services. The different devices and ways of consuming content allow people to catch up when and where they choose. This enables them to engage in the traditional watercooler conversations in the office or to share their opinions on social media, which have become a kind of digital version of the watercooler.

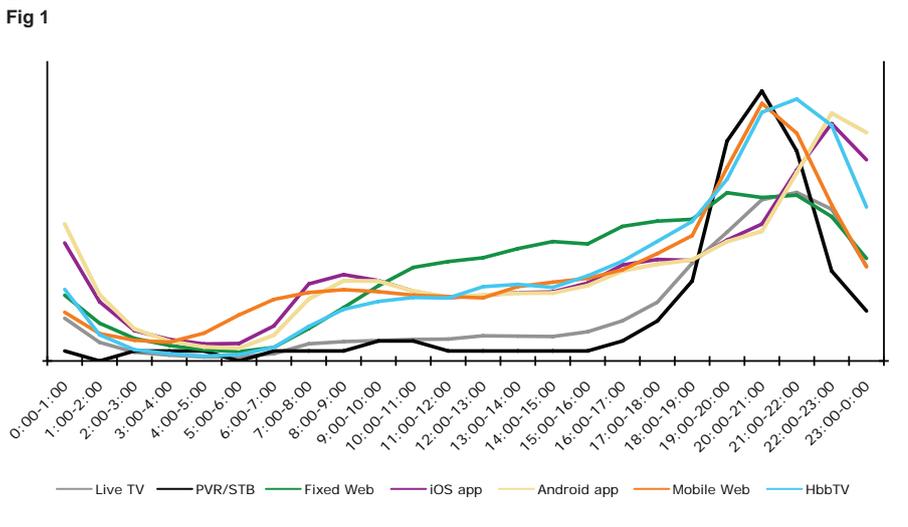
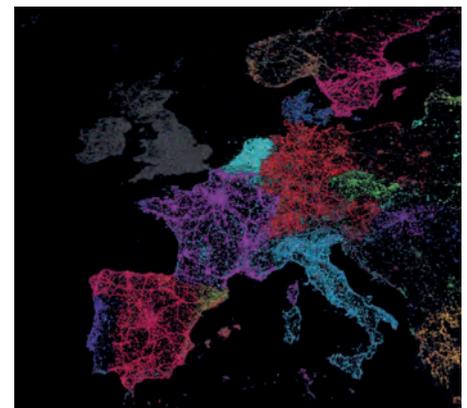
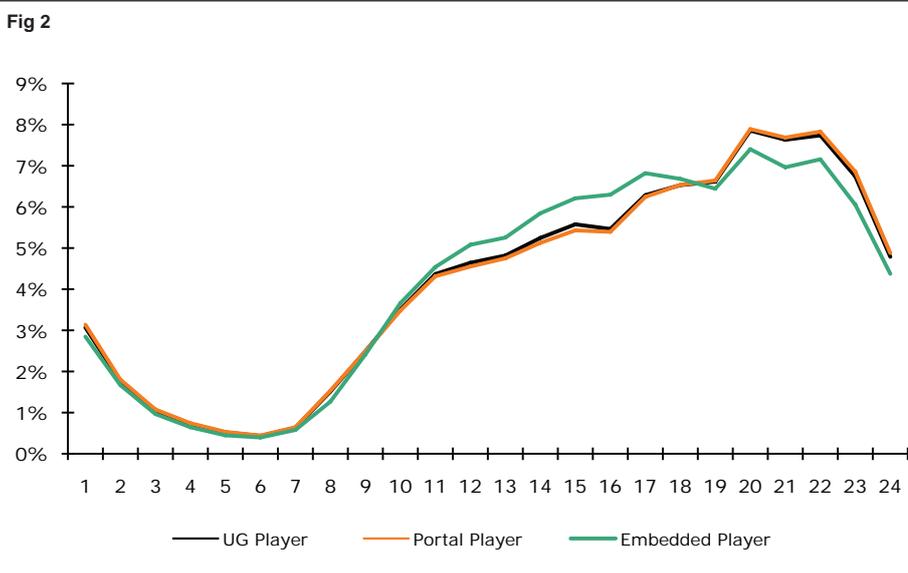


FIGURE 1: THIS GRAPH ILLUSTRATES THE TIME OF DAY AT WHICH NPO CONTENT IS CONSUMED ON DIFFERENT DEVICES (MARCH 2012). THE AREA BENEATH EACH LINE REPRESENTS THE TOTAL VIEWS GENERATED BY A PARTICULAR DISTRIBUTION METHOD. GREY IS LINEAR TV AND BLACK IS PVR/SET-TOP BOX. ON DEMAND USE IS MEASURED FOR PC-OPTIMIZED WEBSITES (GREEN), IPHONE/IPAD APP (PURPLE), ANDROID APP (YELLOW), HBBTV (BLUE) AND MOBILE-OPTIMIZED WEBSITES (ORANGE)

FIGURE 2: THIS DIGITIZED WATERCOOLER EFFECT IS ALSO VISIBLE IN THE STATISTICS OF THE NPO. ABOUT 20% OF ALL CATCH-UP CONTENT IS ACCESSED VIA THE EMBEDDABLE PLAYER, A TOOL THAT MAKES IT POSSIBLE FOR USERS TO POST A VIDEO ON THEIR WEBSITE OR SOCIAL MEDIA ENVIRONMENT. THIS GRAPH ILLUSTRATES THAT THE EMBEDDABLE PLAYER IS THE MOST POPULAR METHOD OF ACCESSING CATCH-UP CONTENT DURING THE DAY, WHEREAS THE PLAYERS WITHIN THE CATCH-UP WEBSITE ITSELF (ORANGE AND BLACK) PEAK IN THE EVENING.

BELOW: A VISUALIZATION OF LANGUAGES USED ON TWITTER, SHOWING THAT PEOPLE TWEET IN THEIR OWN LANGUAGE. MOST TWEETS ARE ABOUT WHAT'S HAPPENING NOW, OFTEN REFLECTING POPULAR BROADCAST CONTENT



A SOCIAL PHENOMENON

One third of the discussions taking place on social media relate to what was (or is) on TV, radio or in the newspaper. 42% of the content on YouTube originates from traditional media and this content generates 66% of the “Most Viewed” category (see Burgess and Green 2012: p.43). Like live broadcast, social media is about what is happening now. If we look at the NPO programmes that are mentioned most often in tweets, we find that those same programmes also generate the most views in the embeddable player that can be used to post a video on social media or blogs. (See also Fig. 2.)

All of this shows that audiences behave differently on different platforms and that people use On Demand services to catch up promptly on what they missed, probably so they can chat with friends and colleagues. On Demand services are therefore complementary to live broadcast and don't cannibalise the audience. They provide a social binding factor as with live television. And, combined with the use of social media to talk about the latest shows, it's as if the watercooler effect has been digitized.

COMPARING THE INCOMPARABLE

We've used statistics from the Dutch public broadcast organization, NPO, for this comparison of On Demand and live TV services. Firstly there is the panel-based audience measurement of live TV, catch-up services on set-top boxes and home recording (time-shifted viewing). Secondly there are pixel-based statistics from websites and online players. Thirdly we have server side logs showing the quantity of data per file that is sent to specific devices. And finally, we have data from the Apple iTunes app store.

From a statistical perspective, it's impossible to use the results of these different measurement technologies as if they were the same. Therefore they are compared on a more general basis to identify behavioural trends for media. We've accounted for the fact that use is defined

differently per measurement method, e.g. the difference between a view, a hit or data traffic.

The lack of a uniform platform-agnostic measurement methodology is a huge problem. This article demonstrates the significance of platform-specific use and these results are important for programme-makers, station editors and distribution managers building platforms for different devices. This is why our colleagues from statistical departments are now opting for watermarking the content itself and measuring use by recording which watermarks are heard or seen by a panel.

Many thanks to Marije Andela, Jeroen Verspeek and Egon Verharen of the NPO for gathering the information used for this comparison.

The Cooperative Imperative

DARKO RATKAJ, COORDINATOR OF THE EBU STRATEGIC PROGRAMME ON COOPERATIVE TERRESTRIAL NETWORKS, EXPLAINS WHY THE GROUP WAS FORMED AND WHAT IT PLANS TO ACHIEVE.



Once upon a time broadcasting meant little more than FM radio and a few national analogue TV programmes. Broadcasters would produce attractive content and bring it to as many people as possible. Terrestrial transmission networks could efficiently deliver broadcast signals to pretty much any receiver. People watched their favourite programmes together with their family on a TV set in the living room. Frequency management and network planning were tasks for engineers. Quality and reliability were paramount.

But those days are long gone.

Broadcasters now produce not only the traditional - linear - programming but also a plethora of on-demand, data and hybrid services. These services are delivered via broadcast networks but also through fixed and wireless broadband. Internet presence is indispensable. Receiving devices range

from large screens to smartphones and tablets. Users' behaviour and expectations are changing. New players are entering the market. The media value chain is increasingly complex. Major spectrum decisions are taken by economists and politicians. The changes continue to accelerate.

How shall EBU Members respond? How can they benefit from the ongoing developments, while at the same time preserving public service values?

Their main task has not changed: they produce high quality content and make it available to their audiences free-to-air. The challenge is to be present on multiple platforms, including the internet, leaving the choice of the receiver to the viewers and listeners.

It is very important for EBU Members to critically analyze the available distribution options, in light of their service obligations, quality requirements, specific national circumstances and available budgets.

Two recurring questions have recently gained prominence:

1. *What will be the future of terrestrial broadcast delivery?* It is uncertain for two reasons: the decreasing amount of spectrum and the inability to reach growing population of mobile user devices, such as smartphones and tablets.
2. *What is the potential of mobile broadband technologies for the delivery of broadcast services?* Mobile broadband is emerging as a powerful delivery platform, it is popular with consumers and globally supported by the industry and regulators. EBU Members should make use of that development.

The EBU's Strategic Programme on Cooperative Terrestrial Networks (SP-CTN) was established to address these issues and their possible impact in the medium to long term.

Its first task was to describe the use cases and their relevance for EBU Members, taking into account the nature of a service, the user environment and the type of receiving device. For each use case the SP-CTN group will examine the appropriate delivery mechanisms, taking account of the overarching criteria of technical quality, reach, cost, and the ability to deliver services free-to-

air. Broadcasters' requirements will be clarified for each case.

The results of this work will be distilled to outline the role of terrestrial networks in the delivery of media services in the future, taking account of both terrestrial broadcasting and mobile broadband, and of their respective development paths. As terrestrial broadcasting and wireless broadband are complementary, the possibility for cooperation between them will also be considered.

The outcome of the work will inform the EBU's activities in other areas, such as radio spectrum, broadband delivery, or network neutrality, and will help to communicate the EBU's views to the industry, regulators and policy makers. Most of all we hope that the outcome of this work will be useful to EBU Members in defining their future delivery strategies. The Members' voice in this work is indispensable.

CTN-MOBILE

A project group, CTN-Mobile*, was established to address the issues specific to mobile broadband. Its principal task is to study how mobile broadband networks can best be used for the delivery of broadcast services to large audiences. It also seeks to identify the possibilities for sustainable cooperation between the two industries.

We have started to build a knowledge base within the EBU community about mobile broadband technologies. CTN-Mobile has become a constructive forum for discussion.

JOIN US!

The next SP-CTN meeting is on 4-5 October in Geneva, under group chairman Roland Beutler (SWR). We will discuss broadcasters' requirements in mobile broadband delivery, use cases and usage patterns, and delivery options. The first step is to join the group on our website: tech.ebu.ch/ctn

*Participation in SP-CTN is limited to EBU members. CTN-Mobile is open to any interested person from the broadcast or mobile industries.



UHDTV and 3DTV: gold mine or land mine?

THE WORLD BEYOND HDTV IS AN EXPANDING UNIVERSE, AND THERE ARE SEVERAL ALTERNATIVE ROADS AHEAD. DAVID WOOD CONSIDERS WHICH IS THE RIGHT ONE.

The evolution of television technology is a challenge for broadcasters. TV broadcasts are not like the world of PCs and internet where, at a stroke, new software can be downloaded, and where users upgrade to a newer PC/laptop/tablet model in as little as two years. Broadcasters have to reckon with the costs and inconvenience of infrastructure change and that (up to now at least) the viewer will only change his television set every 8-10 years.

The consequences for broadcasters of misjudging the timing and type of change are enormous. Have 'wrong' choices ever been made? Yes they have. We could probably, and most respectfully, count PALplus, DVB-H, MAC, and HDMAC among them.

The safe decision today is to conclude that all television broadcasting will eventually be HDTV. We can conclude this because all television sets being sold today are HDTV capable, and sooner or later audiences for non-HDTV services will begin to decline as the public has a new reference point for picture quality.

But what follows or accompanies HDTV?

There is 3DTV. Though it has several forms today, for the public the 3D experience is similar in each case. The 'original' 3DTV system, DVB 3DTV Phase 1, needs an HDTV channel, and provides left and right images with half resolution. Usage has been modest, in spite of the wide availability of the necessary displays. It's out there, but not galloping to success. There is also a Phase 2a to come, which could suit terrestrial broadcasting well where spectrum is at a premium.

But at the same time as these options are available, coming up the inside straight is a new horse in the race: UHDTV (standing for Ultra High Definition TV). There are two variants. The first is a 4k system, which has 8 megapixel pictures, and second is an 8k system with 32 megapixel



images. Within each there are choices to be made about the number of pictures per second and other elements.

When will they arrive? 4k has already been tested in a DVB-T2 terrestrial channel, and tests are also planned for 4k in Korea next year. 8k terrestrial broadcasting tests have been carried out earlier this year in Japan.

So, over the next 10-15 years, the number of 'practical' options for broadcasters will enlarge from SDTV and HDTV to include HDTV-channel 3DTV (in one form or another), UHDTV Level 1 (3840x2160) and UHDTV Level 2 (7680x4320). There are very many factors that will influence what broadcasters should or could do, but one is public attraction. Which will the public find the better way to spend an evening?

This is a balance – so examine what you think is the heaviest side of the scales. 3DTV offered a great 'wow factor' when you first saw it – it was unlike anything you had seen before. Viewers to movies were choosing the 3D version of a movie in droves compared to the 2D version. Audience sizes for 3D movies have now

become less dramatic – but they are still large. The public can get 3DTV at home now with displays that cost no more than high end 2D displays.

For 4k UHDTV systems there will be a new display, and a quality jump compared to HDTV. It's about the same as the jump from SDTV to HDTV. The pictures will be sharper but also appear to have somewhat more depth than HDTV, because of the improved quality of other non 3D depth cues like texture gradients.

For 8K systems there will be yet another quality jump of about the same size, and the pictures will appear to have still more depth, because the depth cues will be even better than for 4k. One other factor is that watching 2D requires less subconscious mental effort – it's more relaxing to watch a 2D programme than a 3D programme. You can watch a 2D programme for longer.

So, that is the equation – with 3DTV more initial 'wow', or with UHDTV sharper pictures, somewhat better depth and longer viewing times. I know where my money is, but I won't prejudice your judgement.

Three cheers for tiers

WHERE CAN A BROADCASTER FIND RELIABLE INFORMATION ABOUT THE PERFORMANCE OF A PARTICULAR MODEL OF HD CAMERA? ANDY QUESTED (BBC), WITH ASSISTANCE FROM ALAN ROBERTS, EXPLAINS HOW THE EBU IS HELPING.

From the beginning of HD transmissions broadcasters have supplied lists of “approved” HD cameras. In the early days this was to prevent consumer products that advertised themselves as full 1080p HD from being used by overenthusiastic producers. However as the number and range of HD cameras grew it became increasingly clear it would be impossible for each broadcaster to keep up with and test every new model, version and option coming to market.

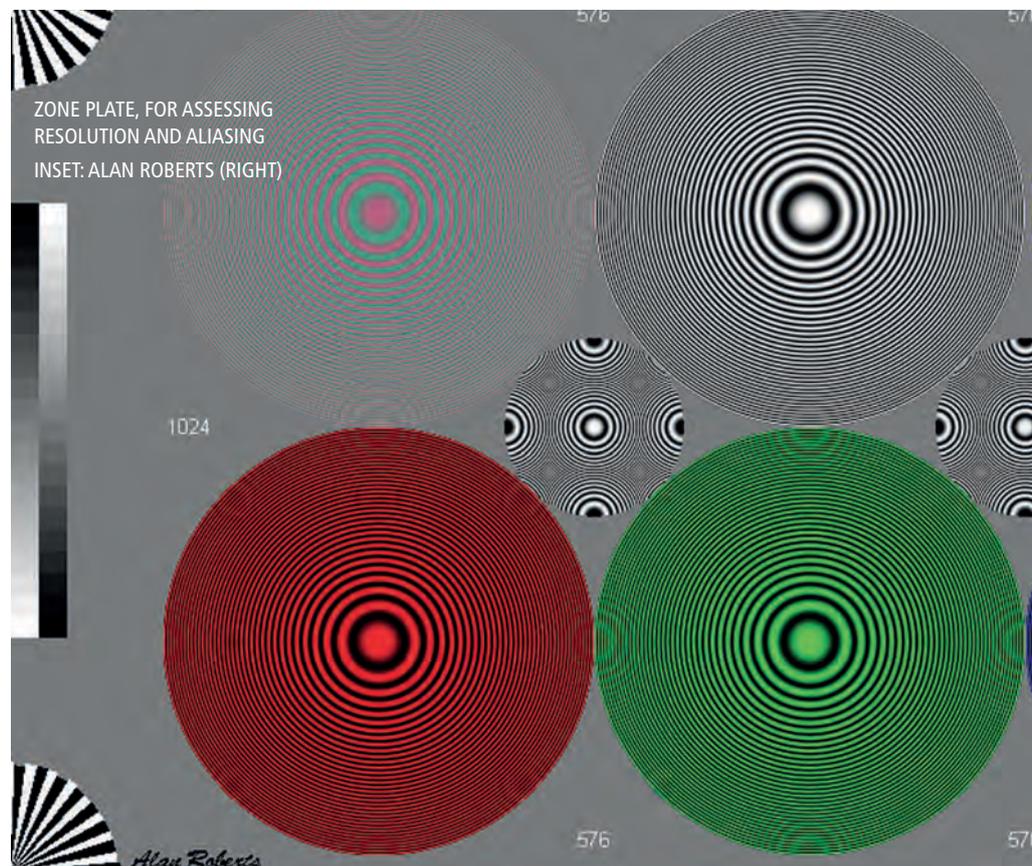
In the USA, Discovery tried grouping cameras into Gold, Silver and Bronze levels. This was tied into the type and the budget of a programme; however it still relied on the broadcaster testing cameras and led to a twice yearly shoot-out that took a lot of time and effort. Several European HD broadcasters looked at the groupings and used the results to help them keep their own approved lists up to date.

In the BBC, Alan Roberts had been working with me on the issues of categorizing cameras for the BBC approved camera list. We were trying to find a way to assess the performance of cameras that would produce consistent results and allow us to target a camera to the most appropriate environment or programme type. Although Alan was working out much of the testing criteria on the fly, one of the principal pieces of work the testing was based on was the BBC R&D White Paper WHP034 Colorimetric and Resolution requirements of cameras, written by Alan and published in 2002.

Alan has taken all the work and his incredible experience of cameras and distilled it into the EBU camera testing document EBU Tech 3335.

Alan says:

Measuring camera performance, and deriving ‘best’ settings for their use, is a complex mix of science and art. It takes a deep knowledge of how a camera works, and how well it works, together with an understanding of the ways in which they are used for a whole variety of programme-types. Historically, only the BBC has done this for HDTV, but now, the methods have been formalized in a single EBU document, Tech 3335.



ZONE PLATE, FOR ASSESSING RESOLUTION AND ALIASING
INSET: ALAN ROBERTS (RIGHT)

Tech 3335 tells how to measure the resolution limits and how the camera reaches them; the dynamic range of the camera and how it reaches it; the noise levels and how they affect the dynamic range; colour performance; susceptibility to infrared pollution; and motion artefacts due to the physical properties of the sensor or sensors. Then, using a combination of these measurements, it is possible to make a good estimate of how the camera has been designed and built, and how to get the best from it for all sorts of programme uses.

None of the test procedures is particularly complex, and no specialist laboratory hardware is needed - it can all be done with a few test cards. Analysis of the results can all be done in the software that is available on the EBU Camera Testing page (<http://tech.ebu.ch/camtest>). It all works, and the program-coding is supplied as well, for budding camera-testers to work out how to do it.

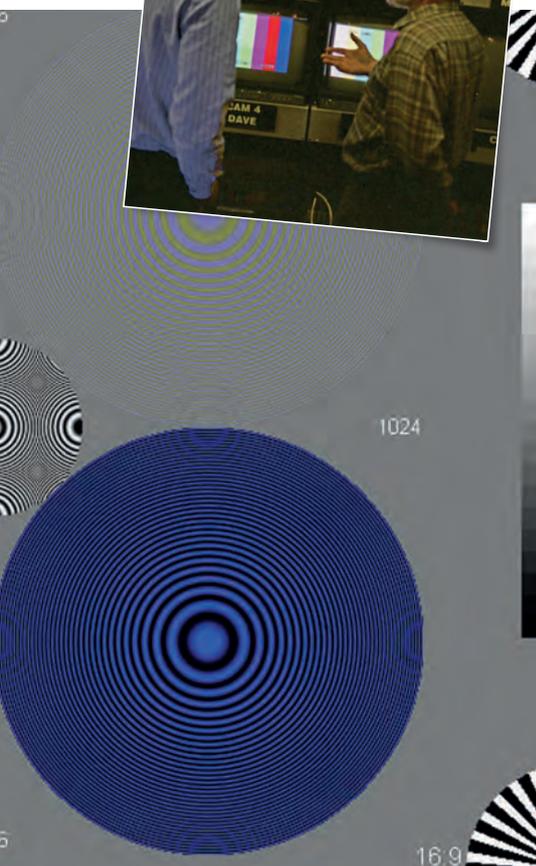
However, deriving ‘best’ settings can still be a challenge, since it involves interpretation of the requirements of programme-makers, and

they often haven't the means to explain their wishes in technical detail. So a flair for the art is still needed, which is why recommended settings can never be definitive, only suggestive.

As Alan suggests, the one thing I am constantly asked is “can I use this camera for my HD programme?” My first response is always to ask “what is the programme you are making and who are you making it for?” The second question is usually “what camera do you want to use?”

There are enough cameras out there to cover most of the acquisition styles and meet technical specifications of broadcasters and co-producers, but there hasn't been a way to tie the two requirements together.

Alan and I had the idea that instead of grouping cameras by type, we would do it by a range of tests and minimum requirements. These groups would cover the entire range of programme styles and quality – from the highest to the lowest



and also including cameras with specialist features (e.g. very high frame rate, covert shooting, in-car etc.).

EBU Tech 3335 delivers a report that can be used to allocate a camera to one of the camera tiers listed in related EBU Recommendation 118. It is then up to the broadcaster to decide the minimum requirements for either a channel or a single programme.

The producer has the latitude to choose the best camera for their programme from the tier specified by the broadcaster. More importantly, if they want to use a new or untested camera, anyone can carry out a test as set out in Tech 3335 – broadcaster, user, manufacturer, camera hire company... The broadcaster can make a decision based on the standard report or submit it to the EBU where, if verified by another member, it will be published.

So far the response from users has been very positive and I would encourage you to have a really close look!



Arild Hellgren NRK



IN EACH ISSUE OF TECH-I WE PUT A MEMBER OF THE TECHNICAL COMMITTEE 'IN THE SPOTLIGHT'. THIS TIME IT'S THE TURN OF NEW CHAIRMAN ARILD HELLGREN, WHO WAS ELECTED TO HIS POSITION AT THE TECHNICAL ASSEMBLY IN ZAGREB IN JUNE.

WHAT ARE YOUR CURRENT RESPONSIBILITIES AT NRK?

I am Senior Advisor to the Managing Director. My heaviest task at the moment is leading the project of building a new DAB network for Norway, which will give indoor coverage of 99.5%. After that we plan to close down the FM network in January 2017.

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

I was initially Technical Director and then Managing Director for ORTO 94, NRK's division responsible for the broadcasting of the 1994 Winter Olympics in Lillehammer. I was responsible for the technical design of the coverage, which was the world's first in the digital domain using the 270 MB standard and Digital Betacam.

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

I felt that I now have the time required and that I have useful experience that I can share with others.

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

I think we on the Technical Committee have to help Members to keep up with the fast pace at which the world is changing, so that public broadcasters are well-positioned when key decisions are taken.

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

I have a cottage down by the seaside, where I go when I need to relax. When I'm there I also do some watersports and some fishing.



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