tech-i

Norway's Digital Radio Odyssey

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67-WP-NH

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Cover Story: The Radio.no roadshow has been touring Norway to spread the word about digital radio and the historic FM switch-off process that has now begun. See page 8.
(Photo: radio.no)

Is the cloud ready for prime time?

Simon Fell, Director, EBU Technology & Innovation

The cloud has become increasingly important to broadcasters. On a recent visit to the US with the EBU Technical Committee, I was struck by how far some implementations have gone in using cloud services. The recent IPO filing by Snap Inc. indicates a $2bn cloud services arrangement with Google and one with Amazon worth $1bn over the next few years. New companies can build their business completely on the cloud and seem quite prepared to do so.

Broadcasters are using cloud-based services more and more, especially for web processes and on-demand services, saving them from building extensive data centres. The speed and flexibility, allowing rapid deployment, are very attractive.

Even leaving aside security concerns, where significant questions remain, not least around the geographical location of storage, there are many technical complexities. A key one is minimizing the 'egress traffic' – the data that is downloaded from the cloud storage – since that is where most costs arise. The more processing that can be done in the cloud, the less data is downloaded to your own facilities. There are, as yet, no low cost interchange rates between cloud service providers. Expensive charges are incurred moving data between a cloud system where it is stored and another that offers the service required. This may change over time as more and more services migrate to the cloud.

One can quickly dial-up servers, storage and compute power, including graphics processors, allowing very complex systems to be assembled in hours. One security benefit proposed is that complex setups can be dismantled immediately in case of security concerns and reassembled automatically from scriptable installations – not easily replicated in a physical data centre!

FIVE NINES IN THE CLOUD?

In my experience, encoding and transcoding implementations are easily established in the cloud and, via parallel processing, can produce real efficiency gains. However, we're not quite there yet with editing and playout. It is suggested that playout can be achieved in the cloud and, by replication of the elements in a playout chain, the much sought-after "five nines" of reliability (99.999%) can be built in. While live channels could suffer from the inherent latency in the systems, they are nevertheless perfectly adequate for a scheduled playout with little complexity in the schedule. Some companies are evaluating virtualization, with playout in the cloud and low latency JPEG 2000 links used for live show injects. However, confidence remains low for most broadcasters.

Despite early experiments, cloud-based editing still seems to be a little way off. Editing multiple streams in real-time does not yet seem possible – but it is coming. Proxies of larger video files are created to simulate the post production workflow and reduce bandwidth, although this adds complexity. Visual effects rendering is now being provided in the cloud; this shows the potential for the future.

One major provider allows clients to use a serverless computing platform where the coded functions are billed in 100ms time slices. This suggests that more efficient coding could lead to minimized costs for cloud-delivered services.

There is plenty to ponder in this digital world of ours – I hope you enjoy this edition of tech-*i*.

Cath Westcott (BBC) moderated a discussion on how broadcasters should adapt to changing consumer behaviours, with panellists Garazi Goia (BBC), Gunilla Ohls (Yle), Jorge Rodríguez López (HISPASAT), Chawki Sahnine (TDA) and Francesca Cimino (EBU Media Intelligence Service).

Forecasting the future of media distribution

The EBU's FORECAST seminar has been guiding Members through the media distribution maze for almost two decades, *writes EBU's **Elena Puigrefagut**.* Over that period, it has evolved from an event focused primarily on technical aspects of terrestrial broadcast into more of a high-level strategic discussion of media distribution technologies. With IP distribution opening up new ways of reaching audiences, broadcasters need to work out how to integrate new business models, new stakeholders and new distribution challenges.

Last November, for example, the 19th edition of FORECAST brought together more than 90 participants representing sixteen EBU Members, several Associate Members, the broadcast and satellite industry and European regulators. Twenty-two excellent presentations across two days (Members can access videos at tech.ebu.ch/forecast16) served as the basis for much discussion and debate. Seven demonstrations complemented the conference sessions. They included DTT and satellite distribution over IP; UHD over DVB-T2, satellite and broadband; DTT and DAB reception in smartphones; and frequency planning software in the cloud.

The great diversity that exists among EBU Members was clear to see. Yle Director of Strategy Gunilla Ohls explained why her organization is moving towards a more internet-based approach to television. They will increase the services on their web player, Yle Areena, while reducing from four to three DTT services. In contrast, Chawki Sahnine, CEO of Télédiffusion d'Algérie, explained the reasoning behind his country's strategy to expand its DTT platform despite the dominance of satellite reception.

The event also provided as clear a picture as possible of the state of 5G developments in Europe. Regulators see 5G as a driver for the digital single market and, as such, the European Commission and the CEPT are defining an action plan for the continent. However, we do not really know how 5G will look, as it is still in the process of being standardized. One advantage of this is that Public Service Media organizations still have the opportunity to feed their requirements into the 3GPP Work Item on Enhancement for TV service ('EnTV').

FORECAST 2017, marking the 20th anniversary of the event, will return to these essential discussions and many more, on 21-22 November.

tech.ebu.ch/forecast2017

We (still) love radio!

PEOPLE ARE PASSIONATE ABOUT RADIO, AND RADIO PROFESSIONALS ARE THE MOST PASSIONATE OF ALL! EBU'S ANNUAL GATHERING OF RADIO EXPERTS, THE DIGITAL RADIO SUMMIT, EXAMINED THE EVER MORE COMPLEX LANDSCAPE IN WHICH RADIO LIVES TODAY. **PETER MACAVOCK** REPORTS.

Do you remember how you listened to radio before the iPhone appeared in 2007? Has it changed? What's going to happen with voice-activated personal assistants like Amazon's Echo? When I was growing up, we listened to one radio station on a kitchen radio where the tuning knob was stuck. Today, the world is my oyster – I can listen to whatever I want, whenever I want. I can like, dislike, store or share anything I listen to. But when I wake up in the morning, I listen to radio. When I'm in my car I listen to radio. Sound familiar?

Norway is currently centre stage, with this year's Digital Radio Summit coinciding with the switch-off of FM services in a second Norwegian region (see page 8). These are momentous times for radio: by the end of the year, Norwegian radio will be DAB+ only, while neighbouring Sweden has no DAB+ and Finland has no digital radio broadcasts at all – and no plans to introduce any. Will the UK and Switzerland be next to follow Norway's example? It would appear so, as their digital listening figures have already crossed the important 50% threshold.

BEWARE OF GATEKEEPERS

Voice-activated personal assistants were one preoccupation at this year's Summit, and the question of how radio will be *found* in an environment where a gatekeeper – albeit

85% OF EUROPEAN CITIZENS LISTEN TO RADIO EVERY WEEK
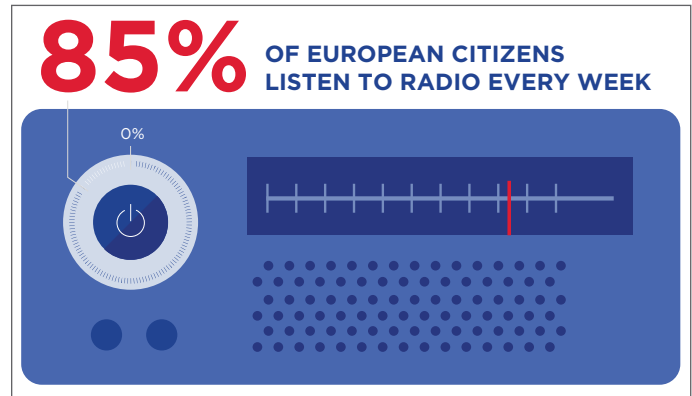
an attractive device that pays attention to my every word – will decide what I should listen to based on how much advertising revenue can be generated from what is proposed. David Fernandez Quijada (EBU) told us that, although the amount of time we spend listening to radio is falling slightly, we still spend an average of 2.5 hours each day listening to it (see page 7). We also heard that radio's audience is aging, but that has provided an opportunity for Norwegian and Swiss broadcasters to launch services specifically targeting older audiences.

The automotive radio experience is important: as one delegate commented during the Summit, most consumers buy new radios only when they buy new cars. Indeed

Will the revolution be in the cloud?

EBU'S **HANS HOFFMAN** REPORTS ON ONE OF THE PTS 2017 KEYNOTES.

Al Jazeera's Miljenko Logozar delivered a stimulating but provocative keynote speech to January's EBU Production Technology Seminar. (*Videos of all of the PTS 2017 presentations are available to EBU Members here: tech. ebu.ch/pts2017.*) As Director of Technology Solutions and Integration, he is responsible for delivering a major transformation project that is moving the broadcaster from a product-oriented approach to one that is service-oriented.

An overhaul of Al Jazeera's facilities and infrastructure, enabling a shift to standards-driven IP-based production in the coming years, is set to be completed this year. However, the media landscape is changing so quickly that Logozar is no longer convinced that simply replacing SDI with IP will be enough. Even implementing the latest software-defined networks will not suffice for a future-proofed organization.

"If you don't know about NFV, you are in big trouble", he said, referring to network function virtualization. The latter, he said, is at the heart of a current revolution in data centres, with the big internet companies at the forefront.

In a wide-ranging presentation, he described how the way broadcasters are currently configured differs so much from the cloud-based approach that is driving companies like Facebook and Twitter. And these are the very companies that are seen as the biggest competitors for a channel like Al Jazeera. He quoted a report from the Reuters Institute for the Study of Journalism:

"More generally, the rise of the video-enabled internet and the distribution of breaking news through social networks and smartphones is starting to provide alternatives to 24-hour news channels."

This trend, which saw 40% of people getting their

this is a global problem, with David Layer (NAB) sharing what he had learned from a survey of new cars in the US. Thankfully, and despite some complex user interfaces, most car entertainment units still have a dedicated radio button. The Summit also heard about industry efforts to bring together the content providers and automotive suppliers, to better understand their respective challenges and harmonize the in-car experience across borders, vendors and services.

Mobile devices weren't left out of this year's Summit. With so many incorporating FM chips, and LG's launch of a DAB/DAB+ enabled phone last year, Alexander Erk (IRT) covered the advances in APIs to help application developers create a seamless listening experience across FM, internet radio and DAB/DAB+. If only we had more phones integrating and enabling broadcast radio services… but we hope to see positive news shortly in this area.

ELSEWHERE IN RADIO WEEK
The Digital Radio Summit comes in a week of radio-focused events hosted by the EBU. On Monday and Tuesday, RadioHack brought together those working on Open Source solutions to help low-cost production and distribution. These activities focus in particular on local and community radio stations, but the tools they are developing have a wider influence in democratizing new technologies around radio.

WorldDAB and RadioDNS hosted a joint automotive workshop that discussed whether touch screens or buttons were more appropriate, and how to ensure that broadcasters exploit the visualization elements at their disposal in connected cars through hybrid and digital radio. Visit: tech.ebu.ch/radio2017.

breaking news from Facebook and Twitter over the past two years, is driving Al Jazeera to rethink completely its approach. Where broadcasters think in terms of deployment cycles of 4-5 years for a production control room, the big internet companies have deployment cycles of hours or even minutes for new web services. For this reason, and others, he said that new, smaller vendors who think differently will steal a march over the established traditional broadcast industry vendors.

He also stressed the critical role of Al Jazeera's cyber security team in all of this: "If you think about cloud, if you think about IP, you first need to think about your security department."

As a challenging keynote, it was an ideal opening to two-and-a-half days of presentations, tutorials and demonstrations exploring an impressive range of emerging media technologies and trends. The Production Technology Seminar does not provide all of the answers, but it does tell you what questions you should be asking when it comes to shaping the future of media production.

Taking the radio reins

WITH MATHIAS COINCHON HAVING LEFT THE EBU TO BECOME CTO OF SWISS PUBLIC BROADCASTER RTS, **BEN POOR** WILL STEP INTO HIS SHOES AS OUR RESIDENT RADIO TECHNOLOGY EXPERT AS OF APRIL 2017. WE INVITED HIM TO INTRODUCE HIMSELF HERE.

Right from my childhood, when I used to sit by my 1980s Philips Roller Radio, enthralled by BBC Radio 1's John Peel show, I knew I had the radio bug. A mercifully short period presenting a show on student radio convinced me that perhaps combining my love of radio and my passion for new technologies might be more fruitful.

I was fortunate to join what became Global Radio's Creative Technologies team, focused on developing new and innovative technology for the UK's largest commercial broadcaster. We worked on projects at the intersection of broadcast and the internet, as well as collaborating with some fantastic people elsewhere in the industry.

Part of this work was helping to define the technologies that would become RadioDNS – an enabler of Hybrid Radio services – and harnessing the power of metadata for connecting broadcasters and their listeners in new ways.

We're reaching a crucial time in radio, where we all need to fully embrace the Hybrid Radio world. This doesn't just mean adding internet to broadcast; it means fully integrated services that allow internet and broadcast to complement each other, and working with others to get the right listener experience.

I am thrilled to be joining the EBU to work on radio technology and I look forward to working with Members in the months and years ahead.

An opportunity for terrestrial TV?

IN HIS PRESENTATION AT NOVEMBER'S FORECAST 2016 SEMINAR IN GENEVA, **MARTIN THORP** OF BBC RESEARCH & DEVELOPMENT EXPLORED THE POTENTIAL FOR ENHANCING IN-HOME NETWORK INTEGRATION OF DIGITAL TERRESTRIAL TV.

In November 2015, DVB's Commercial Module group on terrestrial TV (CM-T) published its Long Term Vision (LTV) report. This sought views on future likely requirements for the terrestrial platform from across the industry. It thus tried to predict the future, which, with current world events, we know can be a difficult task indeed! The LTV report noted that terrestrial TV broadcasting is "perfectly suited to perform its core purpose", but that evolution is required.

One of the key messages was that "strong and seamless integration with home networks" would be important for the future of the platform, allowing in-home devices to find and access terrestrial content seamlessly.

Work on the report led to the formation of an in-home network Fact Finding Mission (ihFFM) sub-group of CM-T. This has been looking to identify whether DVB could do anything to encourage developments in this area. Since the publication of the LTV report, vertical platforms have already been innovating. For example, products such as Sky Q and Virgin Media's V6 box have been launched in the UK market. The ihFFM has asked: "How can industry pull together such functionality for the horizontal CE market?"

A number of interesting observations have come out of this work so far, three of which are outlined here.

Rights Management

The first key thing to mention is just how much rights management issues appear to be dominating developments in this area. Modern broadcasters need to retain control of broadcast material – they often don't own the rights to the content they broadcast. In some markets, manufacturers have been heavily discouraged from allowing content redistribution from PVRs/set-top boxes/TVs for this reason. This clearly discourages integration with home networks. Such problems seem to be even more pronounced with time, as rights holders become more protective and the resolution of content increases.

Trend towards streaming

There is a general trend towards streaming content, and away from caching, although caching could give an advantage to traditional broadcasters if harnessed (e.g. extending PVR style functionality to better integrate with home networks). Caching is often perceived as over-complex, whereas with streaming the broadcaster can typically manage the user experience more effectively. Streaming allows personalization for a specific user's device, targeted advertising, and making editorial changes
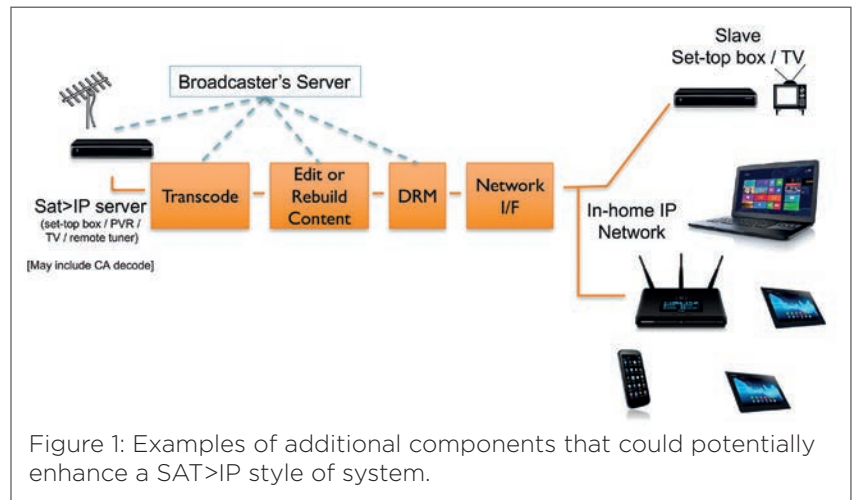

Figure 1: Examples of additional components that could potentially enhance a SAT>IP style of system.

to content, all with Digital Rights Management controlled delivery.

Traditional broadcasting is good

Although there is undeniably a strong trend towards streamed delivery, traditional broadcasting still has a strong position, especially with quality of service, reliability, efficiency of delivery and latency. Many ISPs offering packages including broadcast channels use traditional broadcast to deliver these, including terrestrial.

FACT FINDING

The ihFFM has been considering whether anything could be done to help ease rights management concerns over distributing content to devices attached to a home network. It has also been asking whether broadcast caching could be adapted to support some of the features that streaming offers. Ideas raised have included transcoding of cached broadcast content on a home recorder to suit a specific device requesting the content on a home network. Such a scheme could even include rebuilding / editing the content as per broadcaster requirements including augmenting additional content objects delivered via IP (see figure 1).

The underlying standards required to implement such systems largely exist today, e.g. DLNA and HbbTV 2.0. The SAT>IP standard has also been identified as possibly a good place to start if some of the additional features identified are to be incorporated easily into home networks.

Terrestrial TV is in a strong position, but it needs to continue evolving. Rights management however is a major challenge. There is a window of opportunity for developments in this area, and the time to act would seem to be now.

See Martin Thorp's FORECAST 2016 presentation here: tech.ebu.ch/forecast16

Why radio still needs broadcast

ALL RADIO DISTRIBUTION MAY EVENTUALLY BE HANDLED VIA IP, BUT THIS WOULD ONLY HAPPEN IN THE LONG TERM… AT THE EARLIEST! CURRENT EVIDENCE POINTS TO THE CONTINUED CENTRALITY OF BROADCAST, SAYS THE EBU'S **DAVID FERNANDEZ QUIJADA**, SENIOR MEDIA ANALYST.

Although it is possible to listen to radio on demand, both catch-up radio and podcasts represent a tiny fraction of total radio consumption. For example, in the US consumption of linear radio is 33 times higher than podcasts (Q3 2016, Edison Research). In the UK, the corresponding proportion is 38 times higher, the same as for catch-up radio

people listen to internet radio every day; 55.2% listen to FM radio daily (2016, EGM).

It is interesting to observe what happens in the four countries where the digitization of the airwaves is more advanced. In Norway, where FM switch-off has already started, DAB+ is consumed twice as much as internet radio (2016, TNS Gallup),

minutes are consumed via DAB (Q3 2016, RAJAR). Only in Switzerland does the proportion of internet radio consumption and those listening to DAB+ remain pretty similar, with each at around a quarter of the total consumption, while the remainder, just under 50%, is still FM (spring 2016, DigiMig).

These facts do not mean that broadcasters should simply stick to business as usual. Online-only linear streams and podcasts are growing, but they have clearly been overestimated. Podcasts are interesting because, even if not quantitatively significant, they are being consumed by part of the audience that is increasingly difficult to reach for linear radio: younger, better-educated, mainly male listeners.

In this context, hybrid strategies combining broadcast and IP services, as well as linear and on demand, might be the best option. An understanding of the national context and the consumption patterns of the audience should shape how resources and content are allocated by broadcasters to each of these networks.

Share of total audio time (minutes, Q3 2016)
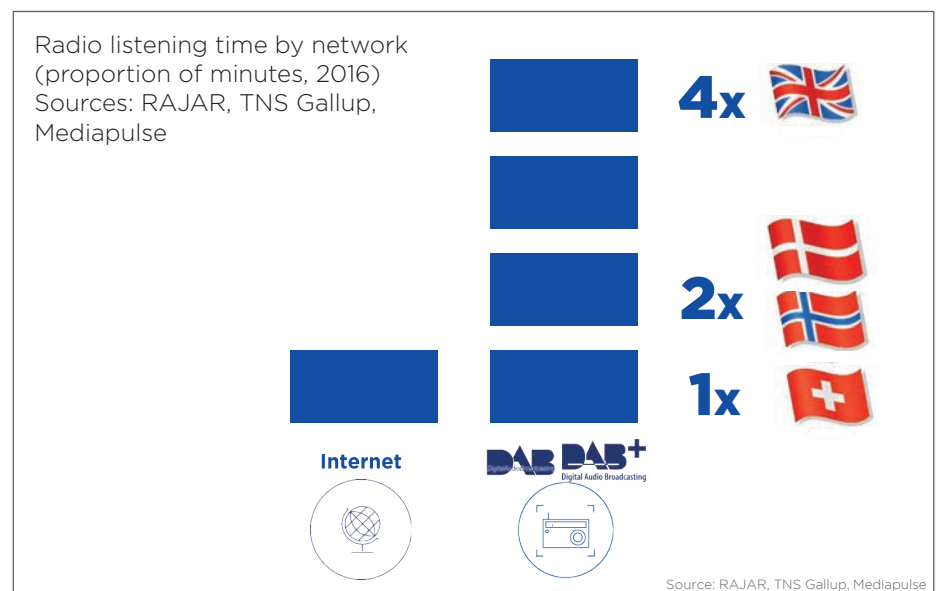Sources: Edison Research, RAJAR
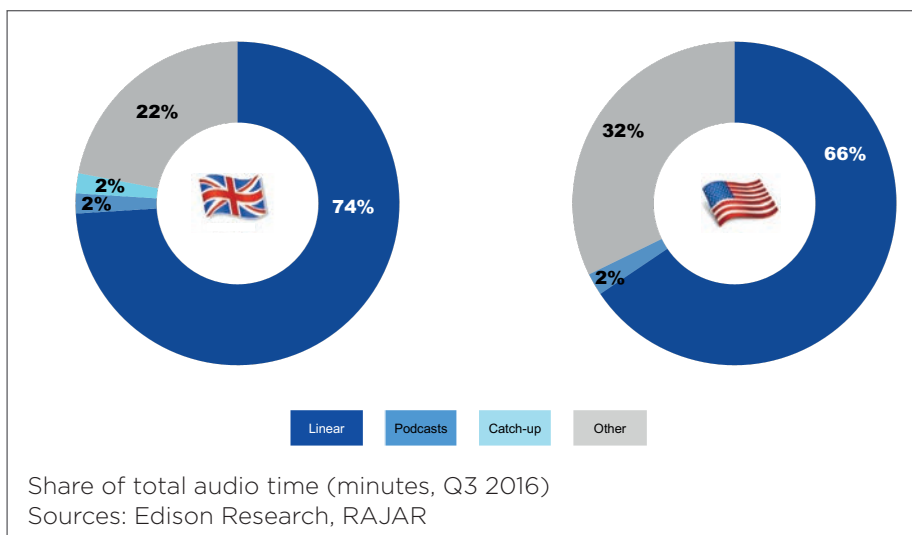
(autumn 2016, RAJAR).

Linear is thus the main way people listen to radio. Most of it is via traditional broadcast networks, where the number of available stations is limited by the capacity of the spectrum, rather than via internet, where thousands of stations from all over the world can be accessed. In the UK, for instance, internet radio represents only 8% of total consumption (autumn 2016, RAJAR). For France, Italy, Germany and Spain the estimates are 6-10% of total radio consumption (2016, EBU).

Even if broadcast and IP-delivered radio are measured in terms of how many people listen to them (reach) instead of how much time people spend with them, the differences are still substantial: in Spain, 3.9% of

a similar proportion as in Denmark (2016, TNS Gallup). In the UK this proportion is even higher: for every minute consumed via internet four

Radio listening time by network (proportion of minutes, 2016)
Sources: RAJAR, TNS Gallup, Mediapulse

Source: RAJAR, TNS Gallup, Mediapulse

Norway's digital leap

ON 11 JANUARY NORWAY MADE HISTORY, BECOMING THE FIRST COUNTRY IN THE WORLD TO START SWITCHING OFF ITS FM SIGNALS. **PATRICK HANNON** (PRESIDENT OF WORLDDAB AND VP OF CORPORATE DEVELOPMENT WITH FRONTIER SILICON) REPORTS ON THIS HUGELY IMPORTANT MILESTONE FOR THE RADIO INDUSTRY.

Digital switchover (DSO) in Norway brings a number of benefits, giving listeners access to a full range of national services (30 on DAB+ instead of five on FM), while removing the cost burden for radio stations of broadcasting on both FM and DAB+. The savings from the analogue switch-off can be reinvested in new, innovative content services.

DSO is taking place over a 12-month period. The country has been split into six regions each with its own switch-off date. Oslo, the capital and major population centre, will start to switch-off FM in September. The final region, in the far north, switches off in December. A phased approach is being adopted in four regions, with public broadcaster NRK switching first and commercial broadcasters following up to 12 weeks later (to help protect their advertising revenues).

To mark the occasion of the first FM switch-off, Digital Radio Norway organized an event in Bodø, where a key focus was on the challenges involved in the switchover process. Line Langnes of the Norwegian Media Authority highlighted three issues: automotive adoption; coverage issues – particularly for drivers; and the interests of local radio.

CARS

As of January, only one third of the 2.6 million cars on the road in Norway had DAB+ installed. This is partly due to people leaving it to the last minute before upgrading their radio. Therefore the challenge is to ensure that motorists understand where and how they can convert their car radio (ideally by visiting a trained installer).

At the same time, it is essential that sufficient devices are available and adequate numbers of installers are trained to complete conversions quickly and effectively. Digital Radio Norway is working closely with broadcasters, manufacturers and installers on these issues.
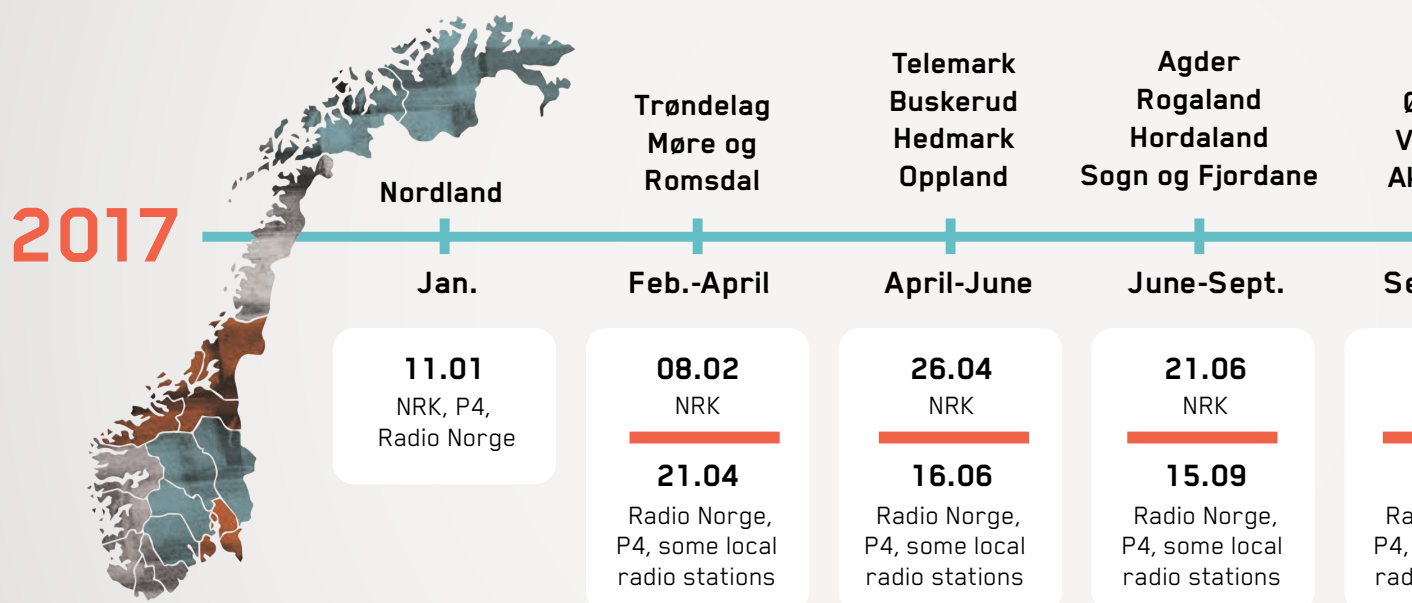
COVERAGE

In the run-up to the start of switchover, several reports of poor quality reception in cars were received. A number of factors contributed to this, including antennas not being properly installed and a lack of understanding about differences in coverage between public service and commercial services. Both of these issues can be addressed through education. Nevertheless, some actual gaps in coverage do still exist, for example in certain tunnels. An installation programme will address these in the coming months.

LOCAL RADIO

While national and larger local stations are switching over to DAB+, smaller stations are allowed to remain on FM at least until 31 December 2021. The regulator will be monitoring the audiences for these stations to ensure they are not adversely affected by the switchover process.

REGIONAL PLAN FOR FM SWITCH OFF IN NO

2017	Nordland	Trøndelag Møre og Romsdal	Telemark Buskerud Hedmark Oppland	Agder Rogaland Hordaland Sogn og Fjordane	Ø V Al
	Jan.	Feb.-April	April-June	June-Sept.	Se
	11.01 NRK, P4, Radio Norge	08.02 NRK	26.04 NRK	21.06 NRK	
		21.04 Radio Norge, P4, some local radio stations	16.06 Radio Norge, P4, some local radio stations	15.09 Radio Norge, P4, some local radio stations	Ra P4 rad

Radio listener Bertih Pauline Olderskog flicked the switch in Bodø, at 11:11 on 11 January 2017, to initiate analogue switch-off for radio in Norway.

The issue of small local stations has also been recognized elsewhere. In the UK, technical trials have been taking place for small scale local DAB services. These have been successful and legislation now being introduced will formalize licensing arrangements. As a result, several hundred smaller stations are expected on DAB in the UK in the years ahead.

...RWAY

Oslo Østfold Vestfold Akershus	Troms Finnmark
...ept.-Dec.	Dec.
...20.09 NRK	13.12 NRK, P4, Radio Norge
...08.12 ...dio Norge, ...some local ...io stations	

Medietilsynet
NORWEGIAN MEDIA AUTHORITY

"It is essential that policymakers have a clear understanding of both the benefits and challenges associated with DSO."

THE REST OF EUROPE

Beyond Norway, several other markets are assessing the possibility of switching off FM. Switzerland is set to start DSO from 2020 and the Italian region of South Tyrol will start switching off FM transmitters in 2017.

Other markets considering the possibility of DSO (when conditions are right) include the UK, Denmark, Germany and the Netherlands. None of these has yet committed to DSO, but the Norwegian experience will clearly inform their decisions. One interesting development in Norway is that adapters for consumer devices have been selling out, showing that consumers do not necessarily need to throw out their old FM radios.

Norway's DSO will also have an impact on motorists from neighbouring countries, especially those making trips into Norway. For carmakers, this raises the question of if and when they should be including digital radio as standard in all European cars. Stakeholders across Europe are calling for progress on this issue and the European Commission is taking a growing interest in this topic.

A key lesson from Norway is the importance of information. First, it is essential that policymakers have a clear understanding of both the benefits and challenges associated with DSO. Broadcasters, the media regulator and Digital Radio Norway have worked hard to ensure that policymakers are fully informed.

The need for information then extends to consumers, retailers and equipment installers. Awareness levels of the switch-off are high, but gaps still exist in the public's understanding of the conversion process. Communication about the benefits of digital radio – and how to make the transition – are the key to success.
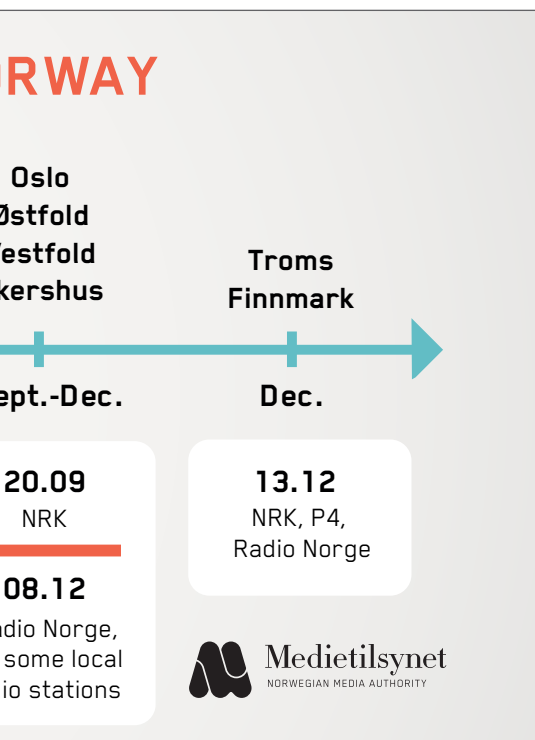
Go with the flow for online distribution

A NEW EBU PILOT WILL DELIVER VALUABLE TECHNICAL, OPERATIONAL AND BUSINESS-RELATED FINDINGS FOR MEMBERS AIMING TO IMPROVE ONLINE DISTRIBUTION PERFORMANCE. PROJECT MANAGER **BRAM TULLEMANS** REPORTS.

Recognizing the requirement for its Members to be able to deliver content reliably over the internet in a cost-effective manner, the EBU initiated a Multi-CDN (Content Delivery Network) project. The new service, called EBU Flow, will start on a pilot basis in April 2017. It has two main objectives: to improve the quality of online delivery and to reduce the cost to the content providers. At the time of writing, participating EBU Members are: RTÉ, VRT, RTBF, NPO and ERT.

The service is based on a strategy of using multiple CDNs in a single service to optimize data flows from the content provider to the audience. Interviews with EBU Members and engagement with the industry have shown a clear consensus that a Multi-CDN is necessary to meet the growing demand for video delivery regionally and in terms of throughputs.

WHY USE CDNS?

Broadcasters increasingly rely on online delivery. Unfortunately, using the best effort network offered by the open internet is more expensive, is operationally less reliable and offers insufficient traffic capacity compared to traditional broadcast distribution methods. By switching HTTP traffic between different CDNs, based on real-time performance data and business parameters, these limitations can be overcome. Stacking of CDNs improves redundancy and increases availability and capacity while driving costs down.

Internet delivery, when compared to digital terrestrial television or satellite, is the most expensive option. A 2015 report from Redshift
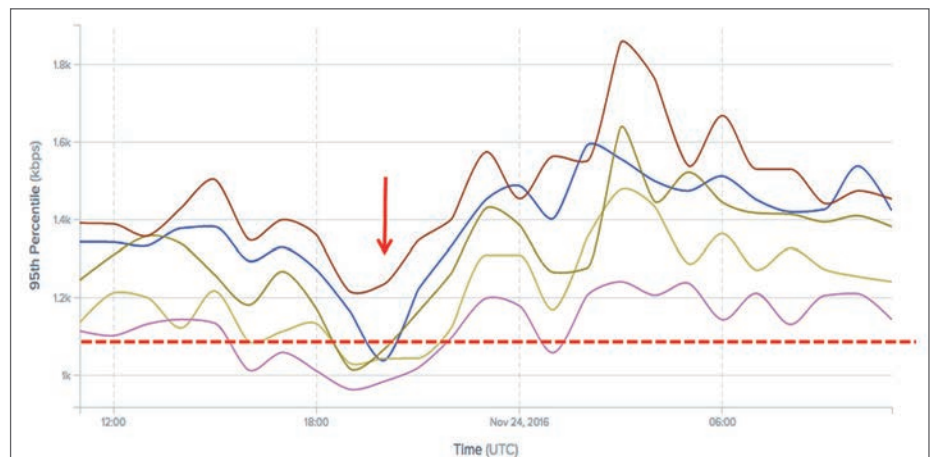

Illustration of the real-time throughput performance of different CDNs. The red dotted line represents a minimal performance for a specific video to play without interruption. At peak time (red arrow) EBU Flow would switch traffic to the brown CDN to avoid service interruption.

Strategy for OFCOM in the UK stated that 2% of Public Service Media (PSM) viewing time in that country was via online and mobile delivery but that delivering these programmes consumed 14% of the providers' distribution budgets. What will happen if this audience grows tenfold to 20%? Will only one-fifth of the audience be responsible for the majority of a single broadcaster's distribution costs? OTT therefore does not seem to be a viable business model for PSM, as there is not a direct relationship between income and reach.

Internet delivery costs are high because invoices are based on traffic consumed by the end users instead of a flat rate per bandwidth, as is common in traditional broadcast distribution. Instead of paying once and allowing millions to enjoy the content on the internet, the actual end user consumed data is the measuring unit. In this model the amount of upfront commitment is highly influential with regard to the actual price paid. From a

cost perspective it makes sense to allocate as much traffic as possible to a single supplier, but this creates an operational risk as all traffic will have to be run to a single arrangement.

With a Multi-CDN setup, the content provider can switch to a lower cost CDN if the quality is good enough. Automatically applying real-time traffic data in combination with business rules enables a dynamic optimal choice of the data flow. It leverages live capabilities of different networks in relation to operational concerns.

SPREADING THE LOAD

Besides optimizing for quality, the load balancing solution can also be used to maximize different bandwidth arrangements, i.e. CDN operators or peering relations. It will be able to fill the 'pipes' efficiently, to comply with different contractual commitments and switch networks dynamically when performance is not good enough. One does not have to bet on the service of a single provider; on the contrary, it

Multiscreen playout using internet delivery strains broadcasters' distribution budgets and requires considerable operational effort. A Multi-CDN solution can drive costs down and create a fully redundant setup that stacks different solutions into a single proposition.

will be possible to add promising new providers or delete low performers. However, it is not all good news with this model, as the switching layer introduces new costs that can be substantial if it has to be operated by a single content provider.

Traffic in a (hybrid) Multi-CDN setup is load-balanced dynamically using real-time traffic information gathered throughout the delivery chain. The most promising source is the measurement of the quality of service experienced by the end user at a certain moment in time in a specific location. EBU Flow does this by retrieving buffer ratios, start-time, download times, etc., from the content provider's player or website that is activated by the visit of an end user. From a privacy perspective, the data collection and processing can be compared with the approach of website analytics tools.

Traffic information from Google Maps provides a useful analogy. If one has to get somewhere, Google Maps will provide potential routes and calculate the time it would take to reach the destination based on the anonymized travel times of other users. Google collects location data from the device, using it to calculate how much traffic congestion there is
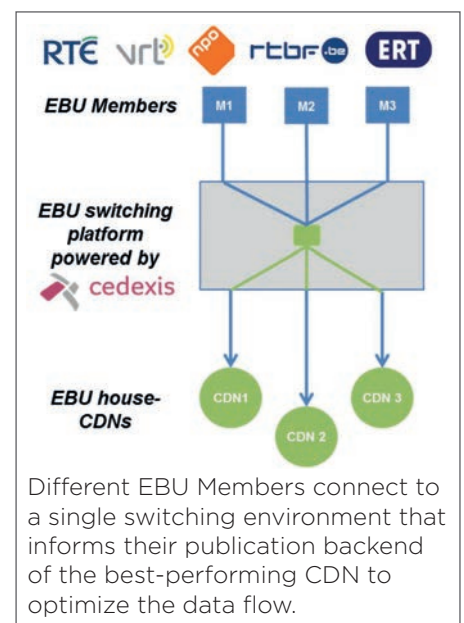
on a given route. If an alternative route becomes quicker Google Maps will recommend this to the end user. With the EBU Flow service the content provider can collate connectivity performance data with respect to different content sources, such as different caches in CDNs, peering relations or from the origin server. The backend of the connected content provider will then be informed about the best performing location. The player will use this as a preference and the other CDNs as fall-back.

FLOW FINDINGS

CDN overlay technology is possible due to the fact broadcasters use HTTP streaming nowadays. This commoditization allows media content to be cached, played out and monitored in a similar fashion. During the EBU Flow pilot, Members will combine the CDNs provided with the pilot with their own arrangements, like their house CDN or peering relations. The pilot will prove whether all parts of the Member delivery chain can be measured in real time and taken into the load balancing equation on their own terms. For example, it should switch traffic to the EBU CDN providers when peering capacity is

fully utilized.

The pilot will provide technical, operational and business-related findings. From a technical architecture perspective it will learn how publication backends should behave in a Multi-CDN setup to safeguard essential broadcast features like geo-fencing, token authentication, HTTPS secured traffic, cache purging, etc. The pilot will also help define which essential metrics should be captured. The performance of different rule-based traffic flow algorithms will be tested to create a fully redundant and cost-effective optimal solution. All single points of failure will be eliminated with

Different EBU Members connect to a single switching environment that informs their publication backend of the best-performing CDN to optimize the data flow.

multiple fall-back scenarios.

The EBU will thus capture requirements for a Multi-CDN setup that will allow Members to tender or deploy such a solution themselves. One potential further evolution could involve the EBU itself providing a Multi-CDN service for its Members.

The future is personalized, with thanks to PEACH

A GEOGRAPHICALLY DIVERSE SOFTWARE DEVELOPMENT TEAM WORKING UNDER A HIGHLY COLLABORATIVE PROCESS DELIVERED THE EBU'S FIRST AUTOMATED RECOMMENDATION SYSTEM LATE LAST YEAR. **MICHAEL DE LUCIA** (RTS) AND **MUSTAFA ISIK** (BR) EXPLAIN HOW THE PROJECT EVOLVED.

Public Service Media (PSM) consumption is becoming more and more fragmented. This fragmentation requires broadcasters to adapt their content and the way they distribute it. Integrating the various platforms and tools is very expensive and requires a lot of support. This is particularly the case for projects around data, and digital transformation is not only a broadcaster problem. Indeed broadcasters, who used to be the big fish for the technology providers, are increasingly becoming a niche market compared to other customers who require similar solutions. Therefore, adapting existing solutions to the very specific use case of broadcasters is expensive and often difficult to maintain and evolve.

THE CHALLENGE OF LIMITED RESOURCES

Looking at the big internet companies, they all started with commodity hardware and custom software, building their system and products iteratively, focusing on the minimal best value for customers. This required them to build engineering teams and create a corresponding organizational culture. This in turn allowed them to quickly adapt as they grew and to optimize their systems to the point where they now design their own hardware. Such companies are composed of more than 70% engineering staff and they can hire the best available.

How can we, in the world of PSM, compete with our comparatively limited resources? The answer lies in our history. More than sixty years ago, the EBU was founded to empower broadcasters to achieve projects that were not in the reach of EBU Members individually. That goal continues to underpin the work of our Technology & Innovation Department, where recent years have seen a growing focus on IP, software and cloud technology.
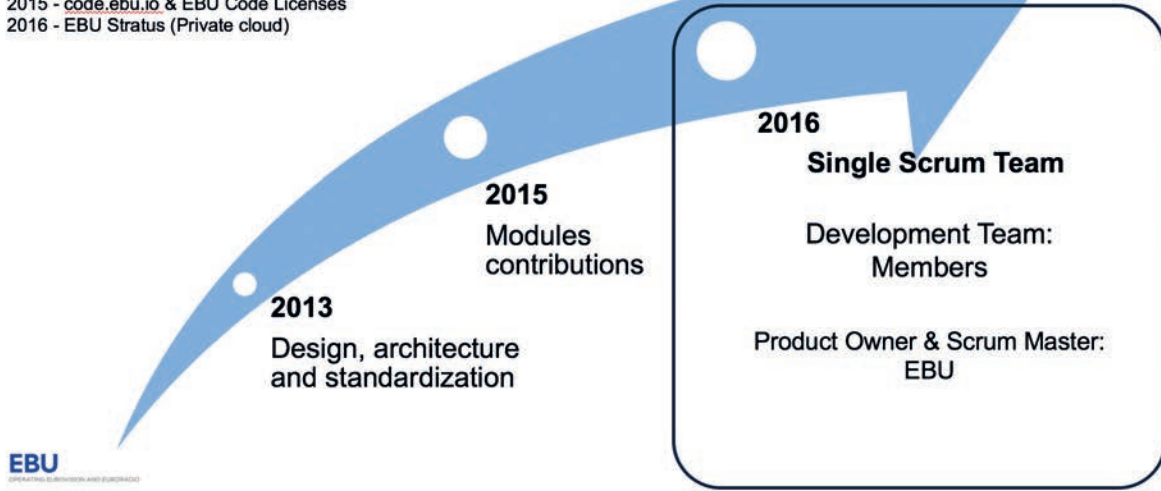
CASE STUDY: PERSONALIZATION

Work on Personalization started three years ago with our Cross Platform Authentication initiative to specify how to associate media devices with online identities. A working group, composed of public and private broadcasters as well as manufacturers, developed an ETSI standard while providing an open source implementation of the system, in order to foster adoption. The collaboration model evolved from designing the system to providing open source modules, leveraging the work of the Agile Software Collaboration Strategic Programme, namely the code-licensing model and the Code Exchange Platform (code.ebu.io).

Acknowledging the fact that the biggest challenge was the time to market, EBU Members Radio Télévision Suisse (RTS) and Bayerischer Rundfunk (BR) decided to join forces to co-develop a white label data pipeline and software solution that would empower broadcasters to deliver personalized media services. RTS and BR each respectively dedicated a few developers to this project, organized

MEMBERS' SOFTWARE COLLABORATION EVOLUTION

2013 - ebu.io & github.com/ebu
2014 - ebu.io/opensource
2015 - code.ebu.io & EBU Code Licenses
2016 - EBU Stratus (Private cloud)

2016
Single Scrum Team

Development Team:
Members

Product Owner & Scrum Master:
EBU

2015
Modules
contributions

2013
Design, architecture
and standardization

EBU

as single SCRUM team. The main advantage *and* challenge of such an approach is the alignment of different broadcasters' road maps, considering the cross-organization, multi-cultural and multi-language setup.

The team, under the name PEACH – relating to its mission, Personalization for EACH – is spread throughout Europe, working remotely from Munich, Reykjavik, Saint Petersburg and Geneva and using the Scrum Methodology. We have a daily call at 10:15, with all team members participating. Collaboration continues throughout the day using Slack (a cloud-based team collaboration tool popular in the world of software development) or video conferencing. Two-week sprints lead to a demonstration of releasable software in front of the stakeholders.

The PEACH team is currently composed of one frontend and three backend developers, a data scientist, two DevOps experts (focused on the software test and release cycles), two stakeholders, one Scrum Master

and one product owner. More EBU Members are on course to join the project, including, for example, Portugal's RTP.

The cross-organization group works as a single team. For example, Veronika, a data scientist from BR, is helping the RTS developers to understand the data sets they are collecting, while simultaneously building experience for the future deployment on BR infrastructure. This approach allows the Members to pool expertise together, optimizing the energy and time spent on the project while maximizing the opportunities to move faster.

SYSTEM DELIVERED
The team delivered a recommendation system that has been running on the RTS homepage since December 2016, as shown in the screenshot above. The system came together in six sprints that leveraged previous work done by the EBU and its Members in the field of personalization.

Visitors to the website of RTS (and soon also the BR Mediathek) can see the results of the PEACH team's work in action. On the Swiss broadcaster's site users are offered automated video and audio recommendations: "*Vidéos/Audio recommandées pour moi*". Site users are informed that the recommendations are generated by an algorithm that takes into account content previously accessed and that increased use will improve the recommendations further.

It is hoped that the new tool will, in time, be widely used among EBU Members, with anonymized data exchange enabling increasingly accurate recommendations for viewers and listeners. While third party solutions are available, their integration is often complex. EBU Members can benefit by running a common, standardized system to provide automated and/or curated recommendations.

As Michael De Lucia said, "built by broadcasters, for broadcasters".

JOIN US!
All the code and findings are available to EBU Members on the Code Exchange Platform. If you are interested in testing the project, please contact Michael De Lucia (RTS, Chairman) and Michael Barroco (EBU).
tech.ebu.ch/personalization

INNERSOURCE COMMONS SUMMIT

18-20 April 2017, EBU, Geneva
InnerSource takes the lessons learned from developing open source software and applies them to the way companies develop software internally. This event, proudly hosted by the EBU, will welcome speakers from PayPal, Bosch and EBU Members. Join us on 18-20 April.
tech.ebu.ch/innersource2017

Video translation with ALTO: workflow simplification

SUSANNE WEBER OF BBC DESIGN & ENGINEERING INTRODUCES AN INNOVATIVE NEW TOOL THAT GREATLY SIMPLIFIES THE PRODUCTION OF TRANSLATED NEWS VIDEOS, AND EXPLAINS HOW IT CAME INTO BEING.

The production of media content across several languages and platforms is both time-consuming and complex. Microphones, sound booths and arrays of editing software are typically required to generate translated audio tracks. With our new video translation tool ALTO we have simplified this process by introducing text-to-speech (TTS) voice synthesis and computer-assisted translation into the re-versioning of video content. This new workflow bypasses the need for microphones and video or audio editing software, and allows a single editor to generate multiple mixed-gender voice-overs.

Most of us have come across one or more of the following technologies: online machine translation, 'digital personal assistants' and translation apps for smartphones, in-language learning tools and many others. The most recent commercial releases of synthetic voice technology have arrived in our homes in the shape of Amazon Echo, Google Home, Apple Siri and Windows Cortana. The quality is now advanced enough to be trialled within the production

process and assessed by producers and audiences.

During a 12-month trial on BBC Japanese and BBC Russian, the BBC World Service, Production Operations and News Labs joined forces to build a web app that uses these language technologies. The result is ALTO (Automated Language Tool), which can be used to re-version short illustrated news reports; these kinds of report are compositions of interviews, vox pops and edited footage, with a journalist's introduction and links.

The audio contained in news packages is usually a mix of the natural sound track (e.g. crowd noise) and a pre-recorded voice-over track that narrates the story. Depending on the video content, the voice-over track can contain several different voices.

CURRENT WORKFLOW

In the current workflow (Figure 1), the re-versioning process begins with the manual translation of a video-transcript into the target language. This is usually done with the help of a text editor. The translated script is required for the subsequent voice-over

recordings: for each voice contained in the video a voice in the target language is required, matching the gender of the original voices. Native speakers must be available for the voice-over recording. The recording itself requires recording equipment and a sound booth or studio.

The journalist then edits the recorded audio clips to remove disfluencies ("er", "um", retakes) and adds the new audio files to the original video in a multi-track audio-video editing application. The editor aligns the audio with the relevant video segments to ensure that the audio is in sync with the number of video frames. Often, the translated script results in a significantly longer text than the original English version. This requires the editor and/or native speaker to paraphrase the translated text and re-record a section until the new audio track matches the duration of the original audio. The editor then balances the audio levels of the various voices to match each other, and then mixes the new voice-tracks with the natural sound of the video.
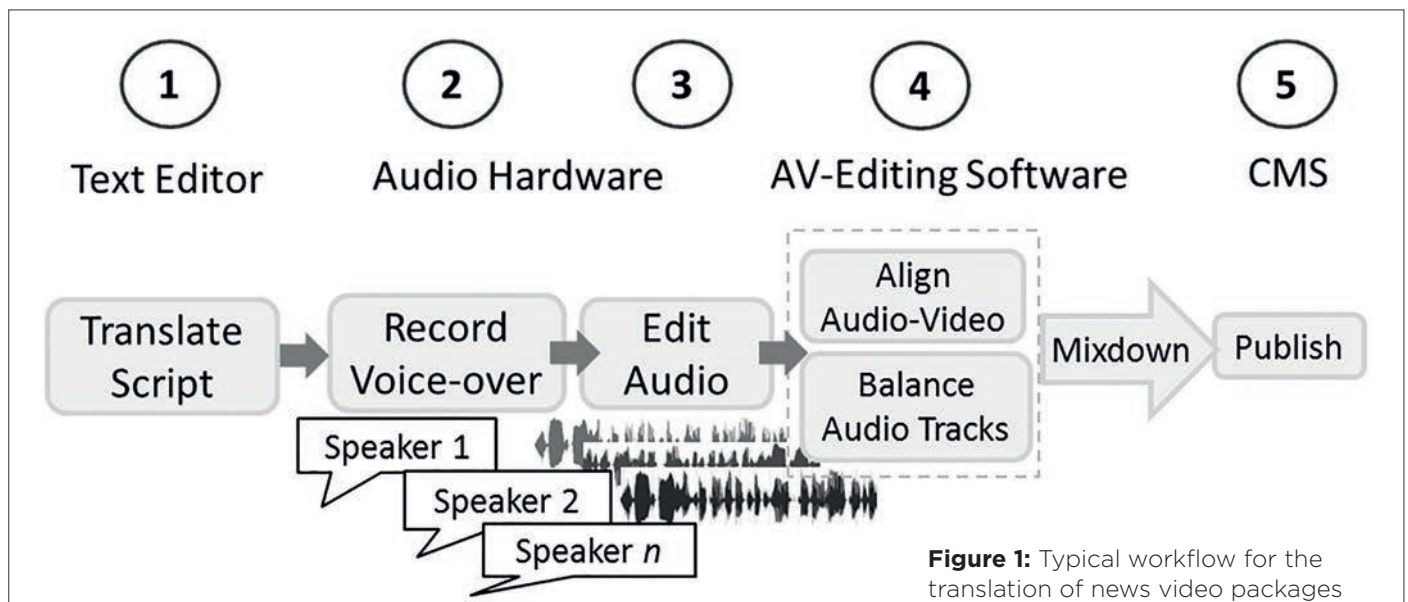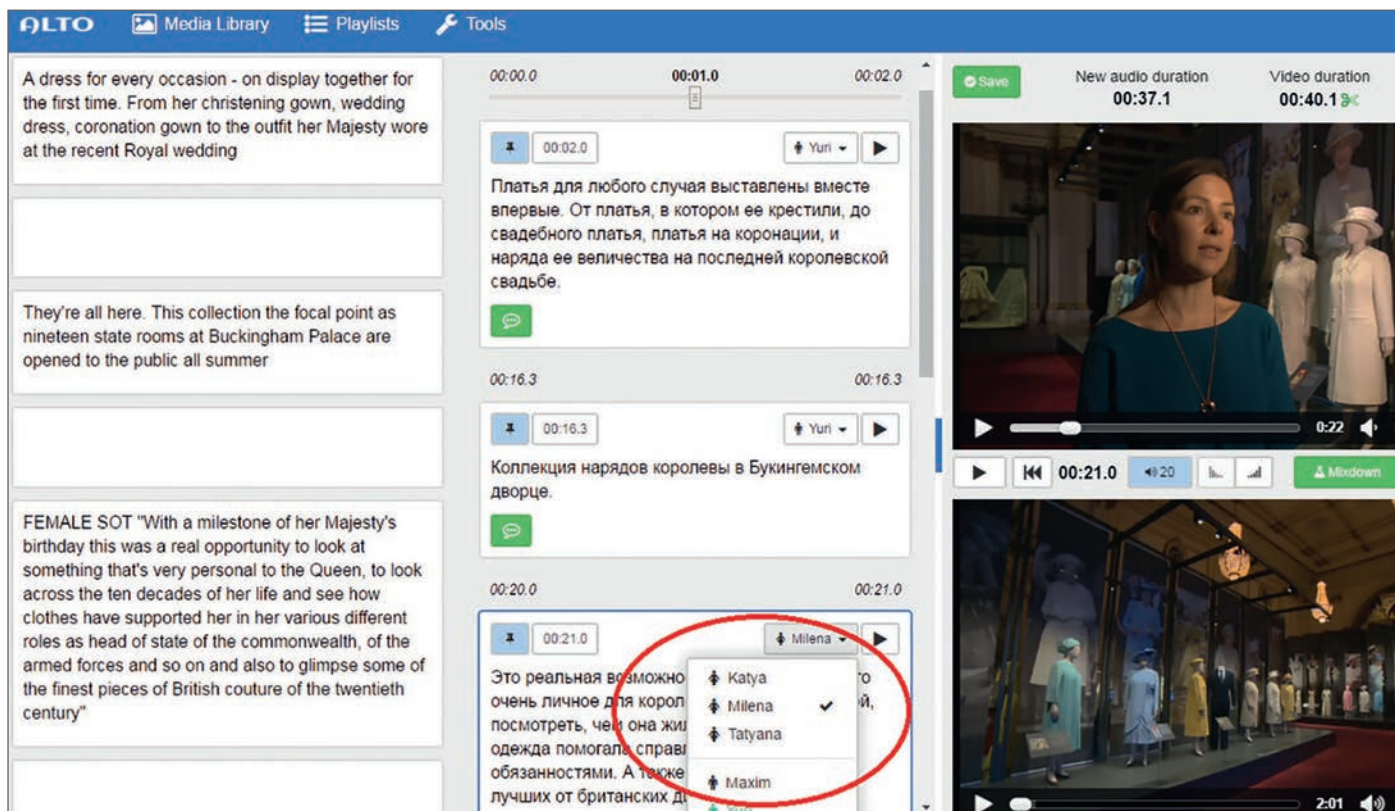

Figure 1: Typical workflow for the translation of news video packages

Figure 2: ALTO screenshot

ALTO WORKFLOW

By using synthetic voices we have bypassed the need for microphones, cables and sound booths, as well as multi-track editing systems. The entire workflow now happens in the same window: the editor uploads the video file, inserts the English original transcript and clicks 'translate'. This sends the English script to the machine translation engine in the cloud (think Google Translate) and returns the translation immediately. Then the editor corrects the translation and selects voices from a drop-down menu for specific sentences and paragraphs. They just need to press 'play' and the new script is read aloud – using another cloud service.

While the script is read aloud the video plays in sync automatically. This way the editor can see if the new script has the correct timing and can simply re-write certain parts of the script (make it longer or shorter) to be read aloud again immediately. They just need to press 'mixdown' to produce the final video file.

There is no longer the need to cut or edit waveform blocks in a multi-track editor – all audio editing is now done purely by editing the script. Another benefit of this particular way of working is that the original transcript is always visible while the editor works on the audio. The parallel text view (Figure 2) means that they can always refer to the original script while refining the translation and the audio.

FOR MORE ON ALTO
bbcnewslabs.co.uk/projects/alto/
susanne.weber@bbc.co.uk

INNOVATION IN ACTION

This innovation is the result of several BBC departments working together – for the first time in this particular combination. The call to arms was a creativity challenge sent to everyone in BBC News, including my home department Production Operations: to come up with an innovative way of reversioning short videos into different languages without the traditionally associated use of hardware.

With my background in sound engineering – having worked closely with language journalists for many years – as well as in language studies, I came up with the idea to voice-over videos using speech and translation technology. The BBC World Service – together with Digital Development – then enabled me to go on a development attachment join BBC News Labs for a couple of years to build the prototype and run a pilot. My position as senior sound engineer in TV was backfilled, while I was given time to develop ALTO.

A unique combination of skill sets eventually enabled this prototyping project to result in a production-ready tool. My background in TV and radio production operations and linguistics was complemented by the prototyping expertise from News Labs. I managed the project under the 'agile' mentorship of the lead developer and with the support of various stakeholders. Two language journalists joined the project for 12 months (also on attachment from a different department), to help design the user interface, to provide feedback on the language technology and to analyse the audience feedback we received during the pilot.

We are now close to the finishing line, i.e. we are handing over the finished product to the team who will take ALTO on as a production tool.
For more on innovation at EBU Members see: ebu.ch/fcp

Roll up, roll up, for the Mystery Tour!

DAVID WOOD HAS BEEN EXPLORING THE CONCEPT OF 'KIRARI' AND HOW IT MIGHT SHAPE A MORE IMMERSIVE MEDIA FUTURE

Are the phenomena of VR and UHDTV isolated media technology developments? Or are they rather islands in the stream, steps forward as part of an over-arching trajectory? Emerging wisdom has it that they may indeed be just part of the great journey to ILE, the Immersive Live Experience.

NTT in Japan has coined a simpler termed for this media nirvana: Kirari. It means "feeling as if you are there". Is media's destiny to provide the means not just for us to be

> *"A mind that is stretched by experience can never go back to its old shape."*

looking at something happening in another place, but to feel all the emotions and the sensory connections that you would if you were there – to make our eyes twinkle and our heart race?

VR and UHDTV are potential contributors to Kirari, but they are not the only ones. Indeed it may be that the combination of many media technology developments will take us to our final destination.

Although the theory of 'true' 3D, in the sense of reproducing what the eyes actually see, is known, the amount of information needed to carry it, the object wave, is well beyond the carrying capacity of the airwaves. Without it we can only offer the more limited stereoscopic image, with its associated baggage of glasses and eye-fatigue. A less bit-rate hungry technique to provide a kind of sampled object wave, called a light field, is under development, but is not here yet.

PEPPER'S GHOST

NTT in Japan have used to good effect a kind of pseudo-hologram system, based on an upgraded 19th century music hall trick known as Pepper's ghost. It's worth a Google search. A high quality image object is projected on to an angled glass that is before the viewing audience, and the result is that the projected object appears to be physically present. If the image quality is high, the result is surprisingly real and has apparent depth. It is particularly effective when used for carrying something like a remote TED talk.

For VR itself, the future may bring more sophisticated systems that make the viewer the centre of a sphere of undistorted vision around him, and the possibility to physically move about in the scene. This is sometimes termed a Type B VR system or panoramic/"six degrees of freedom". Of course, it comes with a corresponding increase in the required bit rate compared to a simple VR smart phone (or three degrees of freedom) system.

Other Kirari tools may include multiple images that allow the viewer to walk around the main object or person in view, not to mention the addition of all kinds of augmented reality data. If you can see, at the same time as the athletes doing their stuff, their running pulse rates and blood pressures, would this make for exciting Kirari?

We can also mention all the many exciting things that could be done with sound, which can add much to the sense of being there.

AT WHAT PRICE?

But all these will come at the price of ever higher bit rates – the need for ever greater capacity for the broadcast or broadband service. So it seems that achieving Kirari will call for at the least the widespread use of the new super-broadband system 5G. This may offer bit rates of up to 100Mbit/s per subscriber – although this remains rather low for delivering an 'object wave'.

There are quite different views about when and if 5G may arrive. But there is much less caution about its early arrival in China and Korea than in Europe. You hear the maxim "5G will be the playground of ILE", which may be true.

There is a proverb: *A mind that is stretched by experience can never go back to its old shape.* Maybe stretched by a more immersive experience, the media will never go back to its old shape. But in the meantime, I'm betting on UHD Phase 2, VR, and maybe Pepper's Ghost.

Extending IMF Metadata

PIERRE-ANTHONY LEMIEUX WORKS WITH BOTH HOLLYWOOD AND SILICON VALLEY CLIENTS ON STANDARDS ACTIVITIES, PROOF-OF-CONCEPT DEVELOPMENT AND TECHNOLOGY STRATEGY. HE HAS BEEN INVOLVED WITH IMF SINCE ITS INTRODUCTION IN SMPTE AND CURRENTLY CHAIRS SMPTE TC 35PM.

The Interoperable Master Format (IMF, specified in the SMPTE ST 2067-x family of documents) is a high quality master format designed to manage the explosion in the number of versions required to service distribution channels worldwide.

At the heart of IMF is the Composition, which corresponds to a single complete work and consists of audio, video and timed text tracks (Virtual Tracks) that reference essence files (Track Files). The Composition is defined by an XML structure called the Composition Playlist (CPL). The CPL and Track Files are combined into Interoperable Master Packages (IMP) for delivery.

BASIC METADATA

IMF defines standard basic metadata, which includes, for instance, information on the creator of the Composition, a Content Title, the geographical regions for which the Composition is intended, points of interests on the Composition timeline (markers), etc.

Much of this basic metadata is extensible, allowing individual users and organizations to define their own values. The following examples illustrate how both house and industry-wide content identifiers (an EIDR ID in this case) can readily be added to the Composition.

```
<ContentVersion>
<Id>tag:example.com,2017:content_
id:ASW34V</Id>
<LabelText>The Great Train Robbery</
LabelText>
</ContentVersion>
<ContentVersion>
<Id>urn:eidr:10.5240:7791-8534-
2C23-9030-8610-5</Id>
<LabelText>EIDR Title (Level 1)</
LabelText>
</ContentVersion>
```

FOUR OPTIONS TO EXTEND METADATA

For metadata that does not fit within the standard basic metadata, IMF allows individual users and organizations to add their own metadata, without having to register it with a central authority. The table below summarizes the four options to add metadata.

Metadata that is essential for the Composition and relatively small ('intrinsic metadata') is carried directly within the CPL as an XML structure. The alternative is 'extrinsic metadata', which is carried as a separate file in the IMP. The following example illustrates the addition of a contact email address to a CPL:

```
<ExtensionProperties>
<ContactEmail xmlns="tag:example.
com,2017:imf">
operator@example.com
</ContactEmail>
</ExtensionProperties>
```

ONGOING WORK

SMPTE Technology Committee 35PM is responsible for the development of IMF specifications. Ongoing work includes improving support for sidecar ('global extrinsic') metadata. For more information, please contact the author (pal@sandflow.com).

> **GET HANDS-ON WITH IMF** A workshop on 30-31 May 2017 at the EBU will help broadcasters understand they key features of the Interoperable Master Format, how it can be used in their workflows and what may still be missing to make IMF even more beneficial for broadcasters. **tech.ebu.ch/imf2017**

The four ways to associate metadata with IMF		GLOBAL	TIMELINE
		Metadata for the complete Composition.	*Metadata associated with specific points on the timeline.*
INTRINSIC	Metadata essential to the Composition and not larger than the CPL	Child element (XML) of the ExtensionProperties element of the CPL. *EXAMPLE: IMF Application the IMP conforms to.* **1**	Resource element (XML) within a Virtual Track in the CPL. *EXAMPLE: timeline markers as specified in SMPTE ST 2067-3* **2**
EXTRINSIC	Metadata that is not intrinsic metadata.	External file (any format) referenced by the IMP. *EXAMPLE: QC report for the Composition in PDF format* **3**	Track File (MXF) referenced by a Virtual Track of the CPL. *EXAMPLE: dynamic HDR metadata.* **4**

DVB in a hybrid world

CHAIR OF THE DVB PROJECT, **PETER MACAVOCK**, EXPLAINS WHY THE ORGANIZATION'S ROLE IS AS IMPORTANT AS EVER, MORE THAN TWENTY YEARS AFTER ITS CREATION.

Question: Is DVB's future in hybrid internet?
Answer: Yes.

The devil is in the detail of course, because hybrid TV means different things to different people, and the internet is now ubiquitous. There is no doubt that the world of television is changing though, and it's not getting any easier.

DVB's job was to digitize analogue TV. It was a very successful organization in producing the technical specifications underlying that transition, and along the way it became a model for how an industry could come together and agree by consensus.

But that was then. Today, DVB involves the same stakeholders and is still specifying the systems involved in TV, but the industry isn't the same. Broadcasters have moved from linear TV services targeting a 21" screen in a living room to providing linear and online services to a range of devices, only one of which is the TV set. And that TV set is now 55", connected to the internet, and sophisticated enough to be a comprehensive media hub in the home. Beyond that there are tablets, mobile devices connected via Wi-Fi, 4G, etc.

STILL RELEVANT?

What is DVB's role now? It's not as simple or as focused as it used to be, but it's arguably more important than ever. Who is going to provide the technologies that facilitate a profitable transition to a hybrid world, featuring multiple devices each with multiple networks? No one organization is equipped to address all these requirements, so DVB will have its place alongside others operating in the space, like 3GPP for mobile, IEEE for Wi-Fi, HbbTV for connected TV platforms, and others.

The business models are changing too, and some operators will see their margins eroded as competition for eyeballs intensifies. That doesn't mean a lesser role for DVB; rather a greater one, seeking to minimize the pain associated with transitioning content across different networks and targeting different devices.

A recent ABU training workshop for young broadcast engineers.

Capacity building at ABU

DIRECTOR OF TECHNOLOGY & INNOVATION FOR THE ASIA-PACIFIC BROADCASTING UNION, **DR AMAL PUNCHIHEWA**, SAYS HUMAN CAPACITY BUILDING IS THE KEY.

Two notable focus points for the ABU in recent months have been the effort to upskill broadcast staff with regard to the latest technologies and activities around digital radio broadcast technology. A DAB+ workshop was held in collaboration with the Arab States Broadcasting Union (ASBU). We look forward to similar collaboration with the EBU, beyond the Digital Broadcasting Symposium (Kuala Lumpur, March 2017) and annual meetings with Technical Committee colleagues.

I was delighted to listen to an industry presentation at Inter BEE 2016 in Tokyo that showed the capability and potential of the cloud. I am glad that in Kuala Lumpur, at this year's skill development workshop for ABU member broadcasters, we discussed those

very topics.

ABU has placed high priority on inclusive broadcasting, to address challenges that arise when broadcasting to people with different abilities. For audiences with visual impairments, we need to provide subtitles and/or sign language, while audio description is required for the hearing impaired. Many APAC broadcasters use subtitles and sign language for some, but not all, of their programming. So, a current challenge is whether we can provide alternative means to access

information for all. Already there are certain tools available, with some countries working to make this a reality. I witnessed some of them during a visit to the NHK research

centre in Tokyo last November, when I was honoured to deliver the IEEE-Broadcast Technology Society Distinguished Lecture at the TV Tokyo auditorium.

In the spotlight
Galina Fedorova
DEPUTY DIRECTOR OF THE DISTRIBUTION NETWORK DEPARTMENT, RTR, RUSSIA

WHAT ARE YOUR CURRENT RESPONSIBILITIES AT RTR?
In my current role as a Deputy Director of the Distribution Network Department of RTR, I am responsible for the launch of digital terrestrial broadcasting of local versions of RTR's channels, with region-specific content. Currently the DTT network is operating in pilot mode and content localization technologies are being tested.
My other responsibility is participating in the working group of the RCC Commission on the regulation of radiofrequency spectrum and satellite orbits. (The RCC is the Regional Commonwealth in the field of communications.)

WHAT DO YOU CONSIDER AS YOUR FINEST ACHIEVEMENT SO FAR IN YOUR CAREER?
My work at RTR has given me the opportunity to contribute to the launch of DTT and to the development of our network architecture in Russia. I have participated in the development of the regulatory framework for digital broadcasting in Russia and have been

an active member of working groups of the Ministry of Communications and Mass Media of the Russian Federation. I consider my work for the EBU Technical Committee as most challenging and exciting.

WHAT ARE YOUR PREDICTIONS FOR BROADCASTING TECHNOLOGY IN THE FUTURE?
First, it's the constant increase of the role of IP technology in the delivery of TV channels to viewers. Broadcasters will need to adapt to the ever-increasing role of the internet. Then, there is the steady trend towards personal TV. Another important trend is demand for interactive TV that, among other things, allows users to consume content at flexible times.

WHAT, FOR YOU, ARE THE MOST IMPORTANT CHALLENGES FACING EBU MEMBERS TODAY?
I believe the biggest challenge is to create a technical development strategy that enables public broadcasters to retain and increase
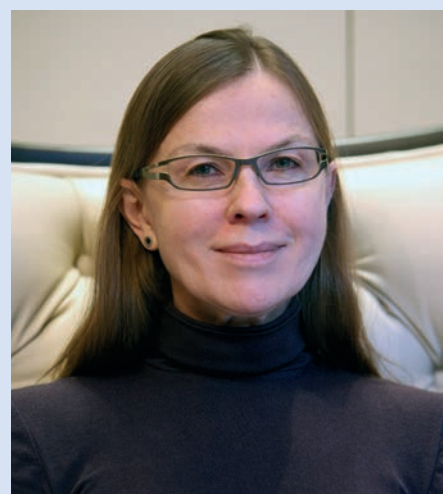
their relevance in a dynamic market with rapidly changing patterns of content consumption. In this context, the main game-changing developments will be the implementation of interactive personalized services and the adoption of new broadcasting technologies that will raise the quality of TV viewing to a new level.

TELL US ABOUT SOME OF YOUR INTERESTS AWAY FROM THE WORKPLACE.
I love travelling; I've made canoe trips on many Russian rivers. But most of all I am passionate about theatre, both music and drama. Russia has a flourishing theatre scene, with many domestic performances and visits of prominent foreign opera, ballet and theatre companies. I attend the best performances in Moscow, Saint Petersburg, other Russian cities, and some in Europe.

OUR SPRING/SUMMER COLLECTION 2017

BROADTHINKING 2017

3-4 May

Where broadband meets broadcast, this year's seminar will focus on http delivery, CDNs, the application of cloud infrastructures for broadcasters, media player interfaces and broadband delivery strategies.

tech.ebu.ch/broadthinking2017

NETWORK TECHNOLOGY SEMINAR 2017

20-21 June

Our essential annual event on media network architecture, focusing on the cloud for contribution and production, virtualization as an enabler for resource sharing, network interoperability, and security of IP facilities.

tech.ebu.ch/nts2017

NETWORK & LEARN: DIGITAL MEDIA NEWSROOMS   27-28 March
Taking place at ZDF in Mainz, this EBU FCP event will explore how to address the challenges of a rapidly changing digital news landscape through innovative products and solutions.
tech.ebu.ch/innovative_newsrooms

INNERSOURCE COMMONS SUMMIT 2017   18-20 April
Applying the lessons of Open Source to all software engineering, using collaboration and transparency to increase quality and speed, the EBU is proud to jointly present this event.
tech.ebu.ch/innersource2017

OBJECT-BASED AUDIO WORKSHOP   17-18 May
The new era of audio production and consumption starts with object-based audio.
A workshop for professionals assimilating this quantum leap in audio creation and dissemination.
tech.ebu.ch/oba2017

IMF WORKSHOP   30-31 May
A hands-on workshop to help broadcasters understand the key features of the Interoperable Master Format (IMF), how it may be used in workflows and what may be still missing.
tech.ebu.ch/imf2017

METADATA DEVELOPER NETWORK 2017   27-29 June
Our annual MDN Workshop is an excellent way to get fully updated on the use of metadata and automatic metadata extraction, and to participate in hands-on demonstrations.
tech.ebu.ch/mdn2017

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tech.ebu.ch/events