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TECHNICAL REVIEW

From the Editor's Desk

Over my time as the Director of Technology and Innovation at ABU, I am proud of the contributions that I have made, not only within the scope of my role, but in editing the Technical Review, which has gained remarkable responses from ABU members and readers. This editorial will mark my final ABU Technical Review over the past five years.

This issue of the ABU Technology *Technical Review* carries reports from technical committee (TC) meetings held in 2017. A number of papers addressing relevant issues for broadcasters are presented in the areas of Ultra High Definition (UHD), Information Technology and Performance analysis of Digital Video Broadcasting-Satellite (DVB-S2) using Matlab.

An InterBEE report, provided by the fellowship recipient, presents impression of the technology discussions at the InterBee-2017 Conference and Exhibitions held in Tokyo.

This issue also contains activity reports on capacity building events conducted and Technical Advisory Services rendered by the technical department in collaboration with ITU, NBTC and AIBD.

The Technical review also summarises the awards presented during the recent technical committee meetings.

The Asia-Pacific Broadcasting Union (ABU) is a professional union of broadcasting organisations in the Asia-Pacific area which aims to co-ordinate and promote the development of radio, television and allied services in the region. It is non-governmental, non-political and non-commercial.

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Next Generation of Television: UHD-1 for More Pixels & Better Pixels

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Deputy Director
(Engineering) at AIR, Vadodara

abstract

UHD has been a buzz word in the TV industry, to follow high definition as a picture format. UHD technology is just not limited to higher resolution, but provides a range of new features for improved, near to realistic, picture quality,. It brings together incredible features like high dynamic range (HDR), wide colour gamut (WCG), high frame rate (HFR) and next generation audio (NGA) to offer an ultimate viewing experience to the user.

Figure 1

In television transmission technology, with screen display progress, simultaneous improvement of the technology in the entire media chain becomes essential. Therefore, full UHD implementation necessitates complete transformation of equipment at studio production, post-production, transmission and consumer devices. However, this technology has also benefited from available secondary methods of distribution and UHD has already been reaching home users via over the top (OTT), cable, Internet protocol based television (IPTV) & Satellite direct to home (DTH) networks. Currently, more and more users are willing to pay for this ultimate experience and high-quality content, therefore, UHD TV has become the next-generation of Television service.

This paper highlights UHD 1-Phase 2 technology, describing in detail about all its features.

1. Background

Ultra High Definition, or UHD, is the next upgrade from full HD (1920x1080) TV. It is the combination of various latest TV technologies and feature trends, including high resolution, High Dynamic Range, Wider Colour Gamut, Higher Frame Rates, and improved audio capabilities.

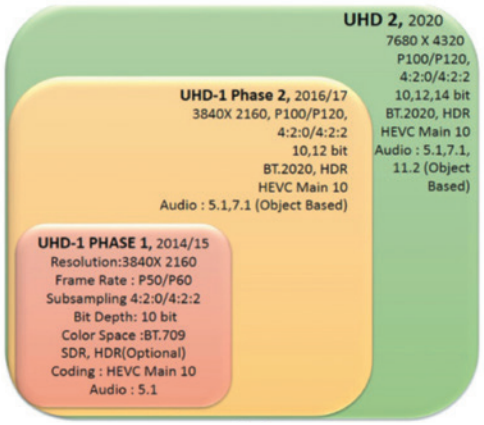

Figure 2: Source – DVB

UHDTV was first specified in 2012 with the ITU-R Recommendation BT.2020. The two key UHD categories are UHD -1 and UHD -2. UHD-1 is further categorised as UHD-1 Phase 1 & UHD-1 Phase 2. UHD-1 phase 1 standard effectively has the parameters of HDTV but with enhanced resolution. In this paper the focus will be on UHD-1 Phase 2 only. UHD-1 is sometimes loosely known as 4K, however, 4K is basically a digital camera resolution standard refering to the cinema format of 4,096 x 2160 pixels at an aspect ratio of 17:9 or 1.9:1 (horizontal: vertical) whereas UHD-1 has 3840 x 2160 pixels resolution and aspect ratios of 16:9 or 1.78:1. For television the pixel count has been adjusted to be a multiple of HDTV's 1920 x 1080. UHD-1 therefore has 3840 x 2160 pixels, exactly four times the resolution of HDTV, whilst UHD-2 is having 7680 x 4320 pixels, sixteen times the resolution of HDTV.

2. Full Featured UHD-TV

2.1 Higher Resolution

The tiny pixel is the building block for images. Millions of

these pixels combine together to form moving images. There are several important things about the pixel. The first is how many pixels there are, which represents resolution. The higher the number of pixels, the more detail the picture has & the ultimate result of the increased pixel resolution is better image clarity, which in turn presents more vibrant, varied and realistic images. Ultra HD television has a native resolution of 3840 x 2160, which is over 4 times the resolution of a Full HD screen – a total of 8,294,400 pixels exactly. UHD-1 enables the use of larger screens without softening or blurring, whereas HDTV would have a visible pixel structure at these large sizes.

For 1080p HDTVs, a viewing distance between 1-1/2 and 2-1/2 times the screen's diagonal measurement is recommended but we can sit closer to a 4K Ultra HD TV – 1 to 1-1/2 times the screen diagonal.

2.2 High Dynamic Range

HDR is a way of displaying the wider dynamic range inherent in the original capture of content. A modern digital camera is capable of capturing a higher level of brightness (luminance) and perceivably deeper blacks, and if this content can be transferred in such a way that retains all this luminance detail and a display is capable of showing it, then the resulting image will be a better representation of what the human eye is capable of resolving.

It is important to realise that HDR isn't simply about increasing the brightness of an image, the idea is to increase the overall dynamic range between black and white by making the dark parts darker and the bright parts brighter, whilst retaining detail when both are in the frame. Contrast is measured by the difference between the brightest whites and darkest blacks a TV can display, as measured in candelas per square meter (cd/m2), known as nit. The ideal low end is completely black, or 0 nit, which can turn pixels completely off. Standard dynamic range TVs generally produce up to 300 to 500 nit, but HDR TVs aim much higher. Manufacturers are claiming 800 to 1,000 nit of peak luminance in HDR TVs.

HDR expands the range of both contrast and colour significantly. Colours get expanded to show more bright blues, greens, reds and everything in between.

Multiple formats for displaying HDR are possible, but currently two popular standards for this are hybrid log gamma (HLG) from BBC and NHK and HDR-10, Dolby Vision from Dolby. Dolby was first to display a prototype TV capable of up to 4,000 nit of brightness. For a short time, Dolby Vision was essentially synonymous with HDR, but later on many popular manufacturers, including LG, Samsung, Sharp, Sony, and Vizio eventually agreed on an open standard, HDR10.

Another key difference is that HDR10 only transmits metadata once, when a video starts playing. Dolby Vision, on the other hand, uses dynamic metadata, which can vary per scene or even on a per-frame basis. Both of these new standards use more bits for colour than the current standards. Right now, colour is usually represented using 8 bits per colour, so each colour can be set to a brightness from 0 to 256 (2828). For HDR-10, 10 bits are used, and 12 for Dolby Vision, giving maximum values of 1024 and 4096 respectively.

Only a system with end-to-end HDR – from the camera, through transmission, and to the display – can deliver an HDR image.

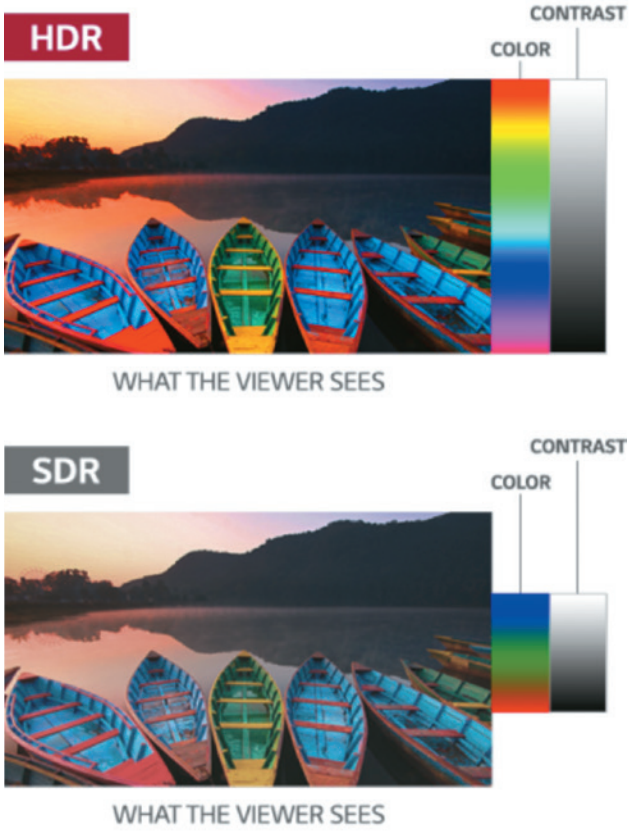

Figure 3:
[Source: http://www.lg.com/us/experience-tvs/hdr/what-is-hdr]

Figure 4: [Source: https://msdn.microsoft.com/en-us/library/windows/desktop/mt742103 (v=vs.85).aspx]

2.3 Wide Colour Gamut

A colour gamut represents all the colours that a TV can display. The bigger the colour gamut, the more colours

a TV can show and the better the picture. The graph in Figure 5 is the CIE 1931 colour chart, two-dimensional (missing luminance) mathematical chromaticity model, a horseshoe shape represent all the colours the human eye can see, which is called the visible spectrum. (CIE stands for International Commission on Illumination - standardisation body) In layman's terms, what we are looking at is the full range of colours that humans can perceive, represented by the horseshoe shape.

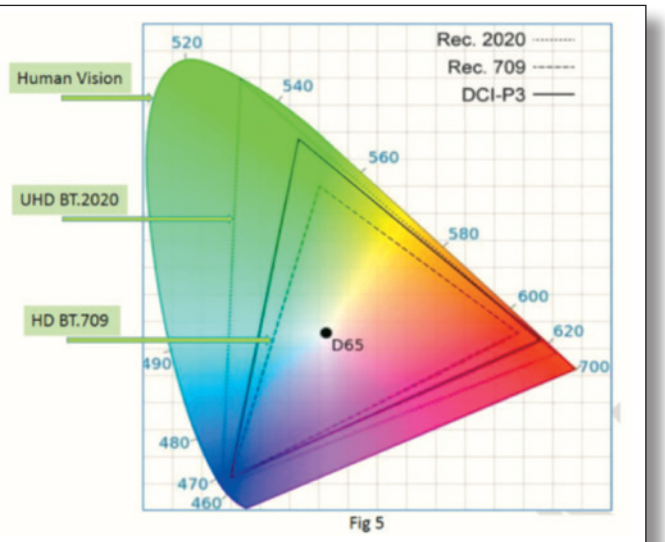

Figure 5: CIE 1931 colour chart

All colours are composed of the three primary colours of red, green and blue. So if we pick a specific point for each of those three primary colours within the visible spectrum we will get a triangle. This triangle is a colour gamut. The bigger the triangle, the greater the percentage of the visible spectrum that it covers and the more colours it can show.

Nearly all current consumer content, including HDTV is created and distributed in the REC.709 colour gamut represented by ITU-R BT.709. But it only represents a small portion of the visible spectrum of colours. The standard used in commercial cinema has more colours and is called DCI P3. BT.2020 standard is the new colour gamut for Ultra-High Definition TVs using largest colour space for video content today. It does the best job of showing all of the colours available in nature, plus many additional colours (neon lights, LED lights, computer generated colours, etc.). The largest triangle in represents the coverage of BT.2020.

WCG content comes in a REC.2020 container. Since not every display can accept REC.2020, therefore, if our display cannot accept REC.2020 then the source should "downconvert" to the REC.709 space.

2.4 Higher Frame Rate

Ultra HD, involves "frames per second" (often referred to as frequency, Hz or fps) or frame rate up to 120 fps. The higher the frame rate, the more likely we will have smooth, natural looking and fluid picture quality, especially for fast paced content.

Today, pretty much all movies are shot at 24 fps and TV programmes at 25 fps or 30 fps (25 pictures per second in PAL countries and 30 pictures per second in NTSC countries). Games are typically rendered at a frame rates between 30 and 60 fps on a game console and up to 120 fps on a PC. In other words, there is a huge difference between the frame rates; and therefore how smooth we will perceive motion. Ultra HD proposes that movies and TV programmes can be recorded and reproduced at frame rates up to 120 fps; 120 pictures each second.

The frame rate is the number of complete still images shown every second – but the refresh rate is the total number of times any image flashes over the course of a second, so a 24 fps film can still have a refresh rate of 72 Hz if each frame is being shown three times, or a refresh rate of 48 Hz if they're only being flashed twice.

When the TV has a refresh rate of 120Hz, it converts the incoming signal (be it 24 or 60fps) to 120 by adding frames. It can do this by repeating frames, inserting black frames, or interpolating new frames by using internal processing. Only progressive scan lines are allowed for UHD, with the progressive scan, all active lines are displayed in each video frame whereas in interlace scan, odd and even lines are displayed in successive frame at half the frame rate. High Frame Rate (HFR) is another new feature that enhances the quality of the UHDTV image especially objects in motion, adding to the sense of reality of the image.

3. High Efficiency Video Coding

HEVC, or H.265 is the latest video compression standard, approved by ITU-T in January 2013, is able to compress video up to twice as efficiently as MPEG 4 AVC/H.264, at the same quality level. The higher compression efficiency also means that for a given bit rate or file size, HEVC encodes video with significantly higher quality than AVC.

A codec is a device having hardware and /or software that uses an algorithm to systematically compress raw video data into a compact form suited for broadcasting and transmitting. At the receiving end our TV must have a built in HEVC decoder.

The higher compression efficiency of HEVC enables efficient recording and distribution of Ultra High Definition (UHD, 2160P) video. While UHD has four times as many pixels per frame (3840 x 2160) as HD video (1920 x 1080), HEVC will enable UHD to be encoded with reasonable bit rates (roughly twice the bits per second required for good HD video today, instead of 4x the bit rate). HEVC is rapidly being adopted by many companies and organisations worldwide.

4. HDMI & HDCP 2.2

The most fundamental connectivity spec in any UHD TV is High-Definition Multimedia Interface, a digital interface. The older spec HDMI 1.4 is designed to support Full HD content. Using HDMI 1.4 cables, the UHD-1 content can only be supported up to 30 frames per second, however, the

newer version of HDMI, HDMI 2.0 is designed to support higher bandwidth (up to 18Gbps), and thus supports 60 fps UHD-1 video.

HDPC 2.2, which stands for High-bandwidth Digital Content Protection, is the latest generation content protection mechanism. HDCP attempts to secure the connection between the source and display, the protection system is much more advanced and stronger. HDCP is usually implemented on HDMI ports, but it can also be used on other types of connections, like DisplayPort and DVI.

5. Next Generation Audio

Audio is important part of video display techniques. The latest Next Generation Audio (NGA) schemes have been standardised to provide immersive and personalised audio content using object- or scene-based coding in UHD 1. NGA was first specified in ITU-R in 2014 with Recommendation BT.2051. This new concept for sound delivery is based on providing a number of audio or sound elements together with instructions (metadata) to the receiver. During playback, the object-based content needs to be 'rendered' to the reproduction layout, such as a multi-channel loudspeaker set-up.

The term 'rendering' describes the process of generating actual loudspeaker signals from the object-based audio scene. This processing takes into account the target positions of the audio objects, as well as the positions of the speakers in the reproduction room. There is no doubt that NGA would enhance the UHD-1 experience. This will become more valuable with larger screen sizes. The NGA systems would also allow the viewer to personalise the sound experience, and it may also allow more additional sound services to be provided. The DVB specification for NGA allows for two methods of encoding the signals: AC-4 and MPEG-H Audio.

6. Challenges

UHD TV content,with its high data density, poses various challenges in distribution through traditional Broadcasting networks, apart from the need to upgrade equipment for production & storage systems. Over the last few years streaming services have improved dramatically, and OTT suppliers have taken the lead in embracing UHD content. They have used ubiquitous broadband and adaptive streaming technology to greatly reduce the cost of content delivery. The reason behind this is that more and more new video technologies are preferentially applied to the IP network and Internet, and it is easier to deploy the multi-screen interaction feature that is widely welcomed by users, based on IP video technology. Over the Top service providers like Netflix, HBO Go, Amazon Instant Video, and Hulu Plus are the main operators in UHD content provision.

However, OTT suppliers cannot provide UHD service with the best QoS. In contrast, carriers with optical networks or DOCSIS3.X networks have more advantages in transmitting UHD TV. UHD TV and broadband bundled charging have been proven to be a successful business model in practice.

7. Conclusions

UHDTV cannot rely only on an increase of spatial resolution. Parameters such as HDR and HFR are key in defining the experience. While sources of true UHD-1 content are currently limited, UHD TVs can play back HD and standard-definition (SD) signals by upscaling the resolution to UHD within the television set.

On one hand, while traditional distributors and TV carriers have yet to provide UHD content for users on a large-scale, the OTT providers have started to support UHD and produce UHD content. Amazon, Netflix are some number of popular service providers offering UHD content. Also major satellite and cable companies are in process of UHD delivery and major studio houses are in content creation process. This technology is definitely worth considering when we next upgrade our television.

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Ms Meenakshi Singhvi received her Engineering degree (with Honours) in Electronics & communications from MBM Engineering College of Jodhpur, India in 1997. She is a 1997 batch IB(E)S Officer and joined All India Radio in the year 1999. She is presently working as Deputy Director (Engineering) at AIR, Vadodara. She has worked at various FM and MW installations & has professional experience of 18 years in the field of broadcasting. Ms Meenakshi Singhvi has been awarded the Akashwani Annual Award in technical Excellence for "Tuning of FM combiners" and a BES award for best technical innovation in "Audio noise Reduction Techniques". She has written various articles which have been published in National and International magazines. She is also a council member of the Broadcast Engineering Society, New Delhi and member of the editorial board of the BES Review, broadcast publication.

Time for ASEAN countries to develop a coordinated spectrum plan for radio

WORLD DAB Digital Audio Broadcasting

ASEAN countries can benefit by moving now in developing a coordinated spectrum plan for the region, in order to fully take advantage of the benefits and economies of scale that broadcasters and governments in Europe have seen.

This was the message from Joan Warner, WorldDAB Vice-President and Asia Pacific Committee Chair, at the recent ASEAN regulators meeting in Brunei hosted by Radio Television Brunei (RTB), where WorldDAB provided an update on progress around the world for policymakers, regulators, and senior officers.

The success of DAB+ in Europe has shown the significant benefits that can be realised by planning digital radio on a regional basis, from reduced costs and spectrum efficiency to helping with audience education and in accelerating the receiver market.

Over 60 million receivers have now been sold around the world and, in Europe, DAB+ is well established as the de-facto future standard for radio. At a local and European Union level, political support is growing for legislation that would require all new receivers to support digital as well as analogue.

At the recent WorldDAB General Assembly in Paris, over 250 delegates heard from advanced and developing DAB+ markets, including Norway which will soon complete the world's first digital switchover for radio and where commercial broadcasters have seen an increase in advertising revenue since moving to digital.

Presentations also covered the latest news from Indonesia and Thailand, where Dr Frederik Ndolu and Dr Colonel Natee Sukonrat provided an update on DAB+ trials, with Indonesia already on air and those in Thailand expected to start next year.

WorldDAB continues to work closely with the ABU and its members across the Asia Pacific region to accelerate progress and help broadcasters and governments move toward a digital future.

WorldDAB at ABU DBS 2018

The WorldDAB workshop will take place at 14:00 on Monday March 5th and the DAB+ Pavilion can be found in the centre of the exhibition area.

To book an appointment, please contact the WorldDAB Project Office at projectoffice@worlddab.org or visit www.worlddab.org/events to find out more.

www.worlddab.org

Analysis of the Information Technology Maturity Level

of the units in the Islamic Republic of Iran Broadcasting (IRIB) based on the ISO/IEC 20000 Standard with a Fuzzy Approach

Dr Mostafa Darjazi
Director of Information Technology and Systems, Planning and Finance Department, IRIB

abstract

In this paper, the maturity level of information systems, with their extensive dimensions, is considered in the units of Islamic Republic of Iran Broadcasting (IRIB). The maturity analysis is formulated as a model with different criteria. The main criteria and their related sub-criteria are extracted from the international standard of the information technology services (ISO/IEC 20000).

In some cases, providing the precise measure of the qualitative and quantitative criteria is not possible; fuzzy system is the approach which is provided in this situation. Therefore, the importance level of each criterion is expressed by trapezius fuzzy numbers. The process requires the decision maker to provide judgments about the relative importance of each criterion and then specify a preference for each decision alternative on each criterion in a decision matrix. In the next steps, Multiple Attribute Decision-making (MADM) weighting methods are used to determine the score of information technology in each related unit. The mentioned steps are performed by grouping weight analysis and fuzzy analytic hierarchy process (FAHP). The FAHP scores indicated the level of the information technology in the related units of IRIB. Then, results are ranked based on the Chen's method (the method for ranking fuzzy numbers) and finally, the best unit with the reasonable level of the information technology are determined

The results of the model and its implementation processes are examined and confirmed by experts of this field in IRIB. It is implemented in some parts of IRIB and their maturity levels in IT area are analyzed. Then, the model is able to be implemented in other units.

Keyword: *Measurement, Information technology, ITIL, Fuzzy AHP, MADM*

Introduction

There is no doubt that taking advantages of the World experiences leads to the enrichment in social systems and phenomena. In recent decades, the implementation of information and communication technology (ICT) projects in different industries makes higher efficiency achievable [1-4].

The area of using information technology (IT) could be expanded by many strategic reasons, such as improvement in the organisational efficiency, processes control and the performance of the internal activities. In the recent study, the maturity level of IT units is considered the Islamic Republic of Iran Broadcasting (IRIB). IRIB is an Iranian media corporation, which holds the monopoly of domestic radio and television services in Iran. It is also among the largest media organisations in the Asian and Pacific region. It consists of some main departments, like Administration, Technical, Political, TV and Radio.

By considering the structure of the organisation, the maturity level of IT units is examined based on ITIL methods (Information Technology Infrastructure Library). The capability of units for implementation of IT services and their execution domains, are some results of the analysis processes. It should be mentioned that the ITIL standard is a collection of best practices in IT areas, which is used as a reference model. It was first developed in the United Kingdom (UK) nearly two decades ago in order to introduce the resources and infrastructural categories required in IT.

For the assessing the maturity level of IT units, different criteria are defined and evaluated by related experts. These criteria are used in the hierarchical group decision analysis method. In the assessing process, experts usually state their opinions with verbal variables, which have some degrees of ambiguity. Fuzzy logic is the approach suggested in these situations to overcome the ambiguities.

The review of previous research in this area showed that most researches are focused on technology performance analysis by statistical methods on the data gathered from questionnaires. Some of the other applied methods in performance analysis are: designing Likert-type scales and assessing the implemented ITs (based on a series of predefined questions), proposing some economic models, such as rate of return (on investment (ROI)), return on equity (ROE), rate of return of shareholders equity, sales growth rate, revenue and profit.

In addition the implementation of strategic planning decisions in the IT area is the other subject considered in performance analysis process. The performance of this criterion is evaluated by measureable variables like the quantity of software, hardware, people skills, networks, and communications[1].

The rapid development and expansion of the IT area makes it necessary to consider some other quantitative and qualitative criteria along with financial ones in the process of performance analysis. These multi-criteria decision analysis could help to solve some managerial problems. Given the extensive range of IT application in operational units as well as some other parts in the organisation, the mail goal of this paper is presenting a model with suitable criteria for measuring the IT maturity level in IRIB units.

A review of the literature in multi-criteria decision analysis has shown the application of some methods like the semi-metric method and the Fuzzy Simple Additive Weighting (SAW) method [5]. In addition, [6] the performance evaluation of IT units is discussed based on the balanced scorecard method via the fuzzy analytic hierarchy process (Fuzzy-AHP).

In the literature, many researches are focused on the Fuzzy-AHP and its application, for example, performance analysis [7, 8], analysis of the IT application and its main factors in the supply chain management [9-11], technology development prioritisation [12, 13], and so on.

However, based on the literature review, there is no specific research which examined the maturity level of IT units in IRIB. In addition, it has not been done in organisations according to our best of knowledge, nor are there any documents available about it. In the present study, the application of the Fuzzy-AHP method is integrated with the ITIL standard proposed data resources. In addition, other relative criteria are defined by the examination of some relative research and consider the best and most common maturity models for the management of the IT services, such as Capability Maturity Model Integration (CMMI), Gap analysis, the Gartner's Maturity Model, and the COBIT maturity model. These examinations provide the first input to the group decision making process and the FAHP method.

The problem definition, solution approach and the results are presented in the following sections.

Problem Definition and Solution Approach

AHP multiple-criteria decision analysis through the Fuzzy approach is the proposed method for the analysis of the maturity level in IT units. AHP was developed by Thomas L. Saaty to solve complex problems involving multiple criteria. An advantage of AHP is that it is designed to handle situations in which the subjective judgments of individuals constitute an important part of the decision process [14]. Here, the main goal of the presented method is minimising related errors. These errors are minimised through the opinions and the judgments provided by the relative decision makers. According to the fact that the judgments are individual-based and may have some kinds of uncertainty, Fuzzy logic is used to control and manage problem analysis. For this purpose, the problem is decomposed into a hierarchy of interrelated elements as shown in Figure 1.

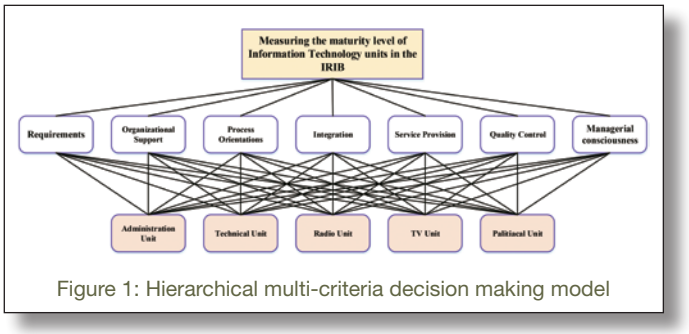

Figure 1: Hierarchical multi-criteria decision making model

The presented model is designed in three levels. The highest level indicates the main goal of decision-making process. Here, the main goal is to assess the maturity of the IT units in IRIB; it is placed on the top of the decision-making hierarchy, and the criteria in the second level are compared with each other based on their effects in gaining the goal. The other levels include sub-criteria and decision-making alternatives.

Decision criteria, decision alternatives and related questionnaires result from examination and comparison of different maturity models in IT service management area, like the CMMI, Gap analysis, tGartner's Maturity Model, and the COBIT maturity model. In addition to maturity models, the ISO/IEC 20000 standard is the other documents referenced in the analysis process.

Considering a problem with a large number of decision alternatives needs reasonable time to examine all candidate solutions. In addition to time complexity, pairwise comparison among large number of alternatives may involve some errors in their score. Therefore, the alternatives are filtered based on the primary interviews with managers and organisational experts. The filtering process included the documents of IT units as another source for decisions. The results of these examinations are five alternative candidates. The main factors of the problem, seven in all, are introduced in detail as follows.

1 It should be noted that in the performance analysis, the importance level of each projects is stated by their weight.

Criteria Definitions

Requirements
This criterion expresses the minimum required infrastructure and the minimum capability of the IT units for gaining a management system. These lower bounds are defined in accordance with universal standards of information technology.

Organisational Support
This criterion expresses the level of organisational support for the execution of the IT management system services, its rules and processes. This support is measured by facilities provided, or the relative policies, rules and manuals, which are released to specify execution process.

Process Orientation
Operating activities in the form of pre-determined processes are some of the main steps in improving organisational maturity level. This criterion determines the number of activities in IT units which operated within the process framework.

Integration
The level of integration among the activities[2] executed in the IT units is presented by integration criteria. It should be mentioned that the integration among different parts of the IT units could also be included in this factor.

Service Provision
This indicates the level of success in providing the process expected outcomes. It also considers the level of satisfying the expectations of personnel, users and customers..

Quality Control
It involves the importance of quality, its measures, and related agreements as well as the lower boundaries which must be satisfied.

Managerial Consciousness
The degree of managers' awareness about their office activities, or the amount of their efforts to get information about the performance of activities their area, will be evaluated by this criterion.

Collecting the Experts' Opinions and Data Analysis

One of the main parts of hierarchical analysis is data gathering, which here is done by questionnaire. The questionnaires are examined and filled in by 30 individuals in the top management and members of the ITIL technical committee in IRIB. The importance of each criterion is determined by pairwise comparison, the comparative weight between the attributes (criteria) of the decision elements are the results of this step. The next step is synthesising, e.g. to estimate the relative priority for each decision alternative in terms of the criterion. As it mentioned in the previous section, experts state their opinions in the form of verbal variables, in this step, these verbal variables are transformed to fuzzy numbers using the Tables 1 and 2.

Table1: Verbal variables in criteria comparisons

Importance	Fuzzy Number
Very poor (VP)	(0.01,0.01,1,2)
Poor (P)	(1,2,2,3)
Medium poor (MP)	(2,3,4,5)
Medium (M)	(4,5,5,6)
Medium good (MG)	(5,6,7,8)
Good (G)	(7,8,8,9)
Very good (VG)	(8,9,10,10)

Table 2: Verbal variables in decision alternatives comparisons

Importance	Fuzzy Number
Very low (VL)	(0.01,0.01,0.1,0.2)
Low (L)	(0.1,0.2,0.2,0.3)
Medium low (ML)	(0.2,0.3,0.4,0.5)
Medium (M)	(0.4,0.5,0.5,0.6)
Medium High (MH)	(0.5,0.6,0.7,0.8)
High (H)	(0.7,0.8,0.8,0.9)
Very High (VH)	(0.9,0.09,1,1)

The expert opinions are aggregated using fuzzy equations that are presented below. It should be noted that in these formula K is the number of experts. m_{ij} is a trapezius fuzzy number presented by 4 parameters. These parameters along with their definitions are given in equation 1 to 5.

$$m_{ij} = (a_{ij}, b_{ij}, c_{ij}, d_{ij}), i, j \in Criteria\ set \quad (1)$$

$$a_{ij} = \min_{k \in K}\{a_{ijk}\} \quad (2)$$

$$b_{ij} = \sum_{k=1}^{K} \frac{b_{ijk}}{K} \quad (3)$$

$$c_{ij} = \sum_{k=1}^{K} \frac{c_{ijk}}{K} \quad (4)$$

$$d_{ij} = \max_{k \in K}\{d_{ijk}\} \quad (5)$$

In this way, the final matrix of the aggregated expert opinions related to the pairwise comparison of the criteria is defined and then, alternatives are compared by considering a specific criterion. The results of criteria comparison are presented in the Table 3.

The fuzzy numbers are normalised based on the geometric mean method. In this way, the weight related to the priorities of the criteria is calculated, and finally, the value of each criterion provided by a non-fuzzy number, is calculated. The process is as follows:

Step 1: "A" is the matrix of pairwise comparison in FAHP. Each element in the matrix is a trapezium fuzzy number, m_ij. It should be noted that in the matrix, there is a relation between each pair of elements *ij* and *ji* which is $m_{ij} = m_{ij}^{-1}$.

$$\tilde{A} = \begin{bmatrix} (1,1,1,1) & m_{12} & \dots & m_{1n} \\ m_{21} & (1,1,1,1) & \dots & m_{2n} \\ \vdots & \cdots & \ddots & \vdots \\ m_{n1} & m_{n2} & \dots & (1,1,1,1) \end{bmatrix}$$

2 Daily, periodic or case type

Table 3: Final Matrix of Criteria Pairwise Comparison

	Requirements	Organisational Support	Process Orientation	Integration	Service Provision	Quality Control	Managerial Supervision
Requirements	1.00 1.00 1.00 1.00	10.00 4.76 4.76 1.67	10.00 1.89 1.72 1.00	10.00 2.00 1.89 1.00	10.00 2.00 1.89 1.00	10.00 1.82 1.72 1.00	10.00 1.82 1.67 1.00
Organisational support	0.60 0.21 0.21 0.10	1.00 1.00 1.00 1.00	10.00 1.79 1.61 1.00	10.00 2.13 2.00 1.00	10.00 2.17 2.00 1.00	10.00 1.72 1.56 1.00	10.00 2.63 2.44 1.00
Process orientation	1.00 0.58 0.53 0.10	1.00 0.62 0.56 0.10	1.00 1.00 1.00 1.00	10.00 2.08 1.92 1.00	10.00 2.38 2.22 1.00	10.00 2.00 1.85 1.00	10.00 1.85 1.67 1.00
Integration	1.00 0.53 0.50 0.10	1.00 0.50 0.47 0.10	1.00 0.52 0.48 0.10	1.00 1.00 1.00 1.00	10.00 2.50 2.22 1.00	10.00 2.17 2.00 1.00	10.00 2.44 2.17 1.00
Service provision	1.00 0.53 0.50 0.10	1.00 0.50 0.46 0.10	1.00 0.45 0.42 0.10	1.00 0.45 0.40 0.10	1.00 1.00 1.00 1.00	10.00 2.13 1.92 1.00	10.00 2.22 2.08 1.00
Quality control	1.00 0.58 0.55 0.10	1.00 0.64 0.58 0.10	1.00 0.54 0.50 0.10	1.00 0.50 0.46 0.10	1.00 0.52 0.47 0.10	1.00 1.00 1.00 1.00	10.00 2.04 1.92 1.11
Managerial supervision	1.00 0.60 0.55 0.10	1.00 0.41 0.38 0.10	1.00 0.60 0.54 0.10	1.00 0.46 0.41 0.10	1.00 0.48 0.45 0.10	0.90 0.52 0.49 0.10	1.00 1.00 1.00 1.00

Step 2: The fuzzy numbers are normalised by the use of the geometric mean method.

$$a_i = \left(\prod_{j=1}^{n} a_{ij}\right)^{1/n} \quad (6)$$

In this formula, a_i is the geometric mean of the first element of the ith criteria. a_{ij} is the result of pairwise comparison between ith and jth criteria. Assuming that the summations of the geometric mean are represented by *(a,b,c,d),* the weight of each criteria is calculated by:

$$a = \sum_{i=1}^{n} a_i \quad (7)$$

$$W_i = \left(\frac{a_i}{d}, \frac{b_i}{c}, \frac{c_i}{b}, \frac{d_i}{a}\right) \quad (8)$$

8th statement represents the weight of ith criteria. These steps are repeated for the other elements and the results are presented in the Table 4.

The same process is done on the pairwise comparison between alternatives by considering a specific criterion. The related results are abstracted in Table 5.

Computational Results

The main goal of the present paper is the analysis of the IT maturity level in IRIB units. For this purpose, among different IRIB units, five are chosen. The decision-making criteria are determined by considering relative standards and documents. The process requires the decision makers to provide judgments about the relative importance of each criterion and then specify a preference for each decision alternative on each criterion. These judgments are provided by 30 individuals in the form of verbal variables. The results of the pairwise criteria judgments and the pairwise decision alternatives judgments are provided by the verbal variables in the Table 1 and Table 2, respectively.

The results of the pairwise criteria judgments are aggregated by the use of (1)-(6) formulas. The relative results are abstracted in the Table 3. Finally, the importance level of each criterion is defined by (7) and (8) formulas, the results are presented in Table 4. The same process is repeated for defining the score of each alternative in accordance with each criterion. The results are presented in Table 5.

By the use of the criteria and alternatives comparison results, the final outcomes are calculated by aggregating the relative weights of the elements to determine the best alternatives/strategies. The following relations were used for this purpose. The final results are presented in the Table 6.

$W_i = (a_i, b_i, c_i, d_i)$: the importance level of each criterion

$V_{ij} = (a_{ij}, b_{ij}, c_{ij}, d_{ij})$: the score of *jth* alternative in accordance with *ith* criterion

$$W_i * V_{ij} = \left(a_i * a_{ij}, b_i * b_{ij}, c_i * c_{ij}, d_i * d_{ij}\right), \quad i \in \{1,2,\dots,7\}, j \in \{1,2,\dots,5\} \quad (9)$$

$$U_j = \sum_{i,j=1}^{n} W_i * V_{ij} \quad (10)$$

Table 4: Criteria Definition by Fuzzy Numbers

	Geometric Mean				Relative Weight of Each Criterion			
Requirements	0.14	0.51	0.52	0.93	0.01	0.07	0.07	0.29
Organisational Support	0.21	0.74	0.79	1.39	0.01	0.09	0.11	0.43
Process Orientation	0.27	0.76	0.82	1.93	0.01	0.10	0.11	0.59
Integration	0.37	0.92	0.99	2.68	0.02	0.12	0.14	0.83
Service Provision	0.52	1.22	1.31	3.73	0.02	0.16	0.18	1.15
Quality Control	0.72	1.38	1.47	5.1	0.03	0.18	0.20	1.57
Managerial Supervision	1.02	1.79	1.92	7.2	0.04	0.23	0.26	2.22

Table 5: Results of Pairwise Comparison Between Alternatives

	Technical	Political	Television	Radio	Requirements
Administrative	0.07 0.43 0.48 1.90	0.06 0.29 0.33 1.53	0.03 0.13 0.14 0.96	0.02 0.06 0.07 0.61	0.01 0.03 0.04 0.38
Organisational Support	0.07 0.42 0.47 2.17	0.05 0.31 0.35 1.57	0.03 0.12 0.14 0.99	0.02 0.06 0.07 0.63	0.01 0.04 0.04 0.40
Process Orientation	0.07 0.43 0.48 2.44	0.04 0.29 0.33 1.61	0.03 0.12 0.14 1.02	0.02 0.06 0.07 0.64	0.01 0.03 0.04 0.41
Integration	0.07 0.43 0.47 2.52	0.04 0.30 0.34 1.62	0.03 0.12 0.14 1.02	0.02 0.06 0.07 0.65	0.01 0.04 0.04 0.41
Service Provision	0.07 0.40 0.45 1.90	0.06 0.31 0.35 1.49	0.03 0.14 0.16 0.96	0.02 0.06 0.07 0.61	0.01 0.04 0.04 0.38
Quality Control	0.07 0.41 0.46 1.90	0.06 0.30 0.34 1.53	0.03 0.13 0.15 0.96	0.02 0.07 0.08 0.61	0.01 0.03 0.04 0.38
Managerial Supervision	0.07 0.41 0.45 2.37	0.04 0.31 0.35 1.60	0.03 0.13 0.14 0.99	0.02 0.07 0.07 0.64	0.01 0.03 0.04 0.40

The outputs, U_j, $j \in \{1,2,\ldots,5\}$ are the overall preference for each of the decision alternatives.

Table 6: Outcomes of FAHP method

	Final Value for Each Unit			
Administrative	0	0.19	0.23	4.35
Technical	0	0.20	0.26	4.69
Political	0	0.09	0.11	4.10
Television	0	0.05	0.07	3.60
Radio	0	0.04	0.05	3.17

According to the final value of each alternative, the priority of all alternatives is determined by Chen's ranking method [15]. In this method, the first step is defining the membership function of each alternative, as shown below.

$$\mu(Administrative) = \begin{cases} 0 & 0.003 \geq X \; OR \; X \geq 4.349 \\ \dfrac{X - 0.003}{0.187} & 0.003 \leq X \leq 0.19 \\ \dfrac{1}{4.349 - X} & 0.19 \leq X \leq 0.234 \\ \dfrac{4.115}{} & 0.234 \leq X \leq 4.349 \end{cases} \quad (11)$$

$$\mu(Technical) = \begin{cases} 0 & 0.003 \geq X \; OR \; X \geq 4.687 \\ \dfrac{X - 0.003}{0.196} & 0.003 \leq X \leq 0.199 \\ \dfrac{1}{4.687 - X} & 0.199 \leq X \leq 0.256 \\ \dfrac{4.430}{} & 0.256 \leq X \leq 4.687 \end{cases} \quad (12)$$

$$\mu(Radio) = \begin{cases} 0 & 0.002 \geq X \; OR \; X \geq 3.167 \\ \dfrac{X - 0.002}{0.035} & 0.002 \leq X \leq 0.037 \\ \dfrac{1}{3.167 - X} & 0.037 \leq X \leq 0.048 \\ \dfrac{3.119}{} & 0.048 \leq X \leq 3.167 \end{cases} \quad (13)$$

$$\mu(Television) = \begin{cases} 0 & 0.002 \geq X \; OR \; X \geq 3.597 \\ \dfrac{X - 0.002}{0.05} & 0.002 \leq X \leq 0.052 \\ 1 & 0.052 \leq X \leq 0.068 \\ \dfrac{3.597 - X}{3.529} & 0.068 \leq X \leq 3.597 \end{cases} \quad (14)$$

$$\mu(Political) = \begin{cases} 0 & 0.002 \geq X \; OR \; X \geq 4.102 \\ \dfrac{X - 0.002}{0.084} & 0.002 \leq X \leq 0.086 \\ 1 & 0.086 \leq X \leq 0.112 \\ \dfrac{4.102 - X}{3.990} & 0.068 \leq X \leq 4.102 \end{cases} \quad (15)$$

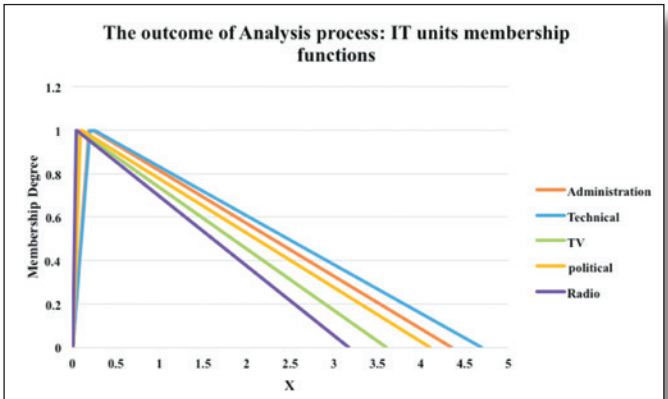

Figure 2: Alternatives membership functions

The next step is defining MMAX and MMIN base on predefined membership functions. The mathematical formulations are provided in below.

$$M_{max} = (0.002, 4.687, 4.687) \quad (16)$$

$$M_{min} = (0.002, 0.002, 4.687) \quad (17)$$

$$\mu(M_{max}) = \left\{ \frac{X - 0.002}{4.685}, 0.002 \leq X \leq 4.687 \right\} \quad (18)$$

$$\mu(M_{min}) = \left\{ \frac{4.687 - X}{4.685}, 0.002 \leq X \leq 4.687 \right\} \quad (19)$$

The next step is defining the intersection points between MMAX and MMIN with each membership function. For each alternative, the intersection points of the upper bound of its membership function and the MMAX, defines IMAX. IMIN is defined in the same way, but the intersection is considered between the lower bound of the function and MMIN. Final outcome, the specific Index named I is defined by IMIN and IMAX and the alternative with the highest score is the best one. The indices are presented in the Table 7.

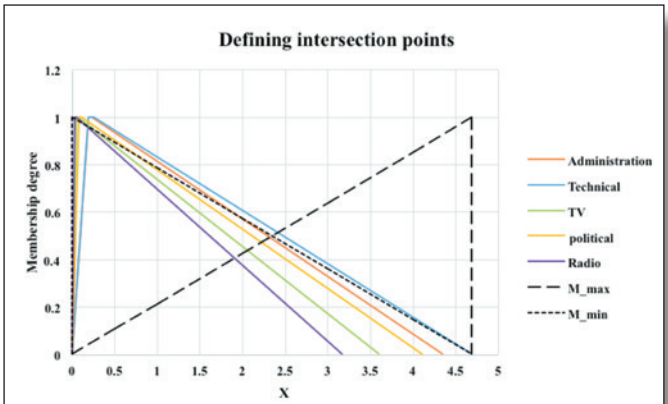

Figure 3: The intersection points among Alternatives membership functions and the maximisation and minimisation set

Table 7: Ranking Alternatives Based on the Indices

	I Max	I Min	I
Administrative	0.494	0.961	0.267
Technical	0.514	0.960	0.277
Political	0.473	0.982	0.246
Television	0.438	0.989	0.225
Radio	0.406	0.993	0.207

Determining the Inconsistency Ratio (IR)

One of the advantages of the hierarchical analysis is tracking the logical consistency, an important consideration in terms of the quality of the ultimate decision relates to the consistency of judgments that the decision maker demonstrated during the series of pairwise comparisons. It should be realised that perfect consistency is very difficult to achieve and that some lack of consistency is to be expected to exist in almost any set of pairwise comparisons. To handle the consistency question, AHP provides a method for measuring the degree of consistency among the pairwise judgments provided by the decision maker. If the degree of consistency is acceptable (less than 0.1), the decision process can continue. If the degree of consistency is unacceptable, the decision maker should reconsider and possibly revise the pairwise comparison judgments before proceeding with the analysis [16].

Inconsistency in judgments may occur through the comparison processes, e.g. when B_i is more important than B_k, and B_k is more important than B_j, then, B_i should be more important than B_j. But, sometimes the opposite result is the real opinion of the people. Therefore, an inconsistency index should be considered.

The proposed method by Saaty is to examine consistency of judgments and defining inconsistency ratio (IR) which is the division of consistency index (II) by the random index (RI). RI is the consistency index of a randomly generated pairwise comparison matrix. It can be shown that RI depends on the number of elements being compared [12].

According to the importance of the logical consistency of judgments used in determining priorities, this index is estimated for all matrixes, pairwise comparison matrix between criteria and pairwise comparison matrixes between alternatives by considering specific criterion. The degrees of consistency are in acceptable range (all of them are less than 0.1); therefore, results are reliable.

Conclusion

The analysis of the IT maturity level in IRIB units is the main subject of the present paper. The maturity analysis is considered as a multi-attribute decision-making model (AHP) among five different units. The main criteria and their related sub-criteria are extracted from the international standard for IT services. The process requires the decision makers to provide judgments about the relative importance of each criterion and then specify a preference for each decision alternative on each criterion. The judgments are

Appendix Questionnaire

The Information Technology Maturity Level Analysis

Personal Information

Name:
Male ☐ Female ☐

Department:	**Position:** Head Manager ☐ Manager ☐ Employee ☐
Education: Bachelor of science (B.S.) ☐ Master of Science (M.S.) ☐ Doctor of Philosophy (Ph.D.) ☐ Others: ----------	**Work experiences:** Less than one year ☐ 1-3 years ☐ 3-5 years ☐ 5-10 years ☐ More than 10 years ☐

Pairwise Comparison between the Attributes of the Decision Elements

Element C_{ij} of the matrix is the measure of preference of the item in row i when compared to the item in column j. Please fill in the matrix by the use of "Very poor (VP), Poor (P), Medium poor (MP), Medium (M), Medium good (MG), Good (G), Very good (VG)"based on your preferences.

	Requirement	Organisational support	Process orientation	Integration	Service provision	Quality control	Managerial consciousness
Requirement	1						
Organisational support	-------	1					
Process orientation	-------	-------	1				
Integration	-------	-------	-------	1			
Service provision	-------	-------	-------	-------	1		
Quality control	-------	-------	-------	-------	-------	1	
Managerial consciousness	-------	-------	-------	-------	-------	-------	1

Pairwise Comparison between the Decision Alternatives base on the Decision Attributes

Same as previous step, by considering your priority of each alternative on specific criterion, please fill in the matrix by the use of "Very low (VL), Low (L), Medium low (ML), Medium (M), Medium High (MH), High (H) and Very High (VH)".

a) Requirement

	Administration	Technical	TV	Radio	Political
Administration	1				
Technical	-------	1			
TV	-------	-------	1		
Radio	-------	-------	-------	1	
Political	-------	-------	-------	-------	1

b) Organisational support

	Administration	Technical	TV	Radio	Political
Administration	1				
Technical	-------	1			
TV	-------	-------	1		
Radio	-------	-------	-------	1	
Political	-------	-------	-------	-------	1

expressed by verbal variable (as a kind of trapezius fuzzy numbers) by 30 individuals. The results of the pairwise criteria judgments and the pairwise decision alternatives judgments are aggregated in the form of fuzzy numbers. These numbers are ranked based on the Chen's method (the method for ranking fuzzy numbers). In this method, the index I is the main index in ranking process and is calculated for all units.

According to the index I, it is obvious that the Technical unit has the highest score in the information and communication management area, e.g. it is considered as the superior unit; the ranking of the other units is as follow: Administrative unit, Political unit, Television unit, and Radio unit. The other results are abstracted in the following:

1. It is the first time in Iran that the universal standards (ISO/IEC 20000) have been used to determine the criteria of assessing the maturity level of IT units. Therefore, it can be considered as a proper reference for other studies.
2. The proposed model for the maturity level analysis of IT units is based on the fuzzy set theory and AHP method, that could be a useful guide for managers in identifying the strong and weak points of IT application in their organisations.

Acknowledgement

This paper is supported by IRIB organisations. I would like to thank the all the experts and specialists of IRIB organisations for their participation in the survey who supported my work in this way and helped me get results of better quality.

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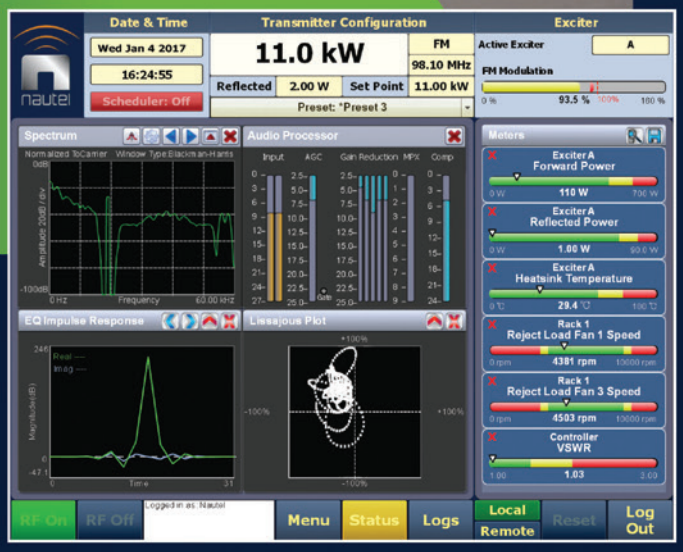
Darjazi graduated as an Elegant Student in the MSc of System Engineering from the Iran University of Science and Technology. He has published several special articles in the different fields of industrial and system engineering (Green supply chain, Risk management, Performance analysis, Pricing, Resource allocation, project management etc.) which are resulted from the real problem analysis and performance improvement.

With over 14 years of experience in Project Management, Information Technology Project Analysis, Engineering Consultant, Business Process Management, System Identification, System Administration, System Deployment, System Development, Darjazi follows up the relative activities in the planning, analysis, decision making and control of the main projects in IRIB. He managed the last two Media Technology conferences.

He has integrated the main concepts of the industrial and system engineering with information technology projects to manage their uncertain environments and improve their efficiency and outcomes. Some of his main experience includes: Developing Smart Data Pricing models in The IPTV/OTT services, Risk management of data centres, Design and deployment of Planning and Control system, Design and developing of the Service desk concepts and services, Performance Analysis of IT departments based on ITIL Standard, Cooperating in IT, IPTV, digital archives projects, Design and analysis of purchasing system, Supply chain management optimisation, analysis of reliable production systems, feasibility studies and so on.

FM AND MW TRANSMITTERS

REAL TIME BUILT-IN INSTRUMENTATION



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ABU Technical Committee Meetings in Chengdu, Sichuan

1. Opening Session


Mr Masakazu Iwaki

Mr Masakazu Iwaki, Chairman, ABU Technical Committee, welcomed delegates to the Technical Committee meeting, held together with the 54th ABU General Assembly, and thanked the host organisation for all their work in making the preparations. He provided an overview of the two days of interesting topics to follow, together with updates of activity in the region.


Mrs Sun Sichuan

Mrs Sun Sichuan, Deputy Director General, Science and Technology Department, SAPPRFT/RPTRC-China, warmly welcomed all the visitors to Chengdu from within the region and beyond. She noted that the ABU TC had, for a long time, championed broadcasting technology solutions suitable for all ABU broadcasters and that this had helped to bring harmony. The ABU TC had become an important bridge among broadcasters in Asia-Pacific and around the world. She said that the Chinese government placed great importance on broadcasting to allow all citizens to enjoy high quality information and entertainment. In recent years, with the rapid rise of IT, Chinese broadcasting had been under exceptional pressure to innovate. To meet this need, the Chinese media would undergo many changes: opening up programme production; opening up content distribution and opening up transmission links.

As China is the biggest market in Asia-Pacific region China has an important role to help the development of broadcasting across the Asia–Pacific region and the world. Finally, Mrs Sun wished everyone success.


Dr Javad Mottaghi

Dr Javad Mottaghi, Secretary-General, ABU, added his welcome. He said he was delighted to be in Chengdu and thanked the hosts for inviting us and providing such a beautiful location. The ABU -action plan started last year and would run to 2020. The long-term action plan was already providing results, but of course, more needed to be done to meet the challenges of the region. In particular he recognised the digital divide that exists between the most advanced technology leaders in the world, and those

with more traditional facilities. The technical strategic plan allows the ABU to move together to fulfil the ideals of the organisation to help each other.

Dr Mottaghi observed that the ABU TV Song Festival would be seen by over billion people. This was an amazing thing and the ABU must think carefully about what it could mean for the future. He noted that the ABU Secretariat is striving to do more for all the members and that to facilitate this members needed to continue to keep the Secretariat informed of their needs. He referred to the growing partnership with sister Broadcasting Unions and looked forward to the prospect of doing more in Sport, News and Technology together.
Picture-3-Dr Javad Mottaghi

2. Announcement and Presentation of the 2017 ABU Technical Review Prizes and Engineering Awards Announcements

Dr Amal Punchihewa, Director Technology & Innovation, ABU, introduced the awards session.

Technical Review Prizes – Commended & Best Articles

Presented by Mr Sheng Zhifan, CTO, Academy of Broadcasting Science of SAPPRFT/RTPRC-China

Commended article 2: Dr Li Leilei, Academy of Broadcasting Planning

Commending article 1: M S Duhan, Doordarshan, India

Best article: Dr Shogan, Kamei, Nakazawa, Tanaka, BSat, JTEC, NHK, NHK

ABU Green Broadcast Engineering Award

Presented by Mr Hamid Dehghan Nayeri, Director, International Technical Affairs, IRIB-Iran, Panel Chairman, ABU Industry & Green Awards

Joint Winners: CCTV, China and MediaCorp, Singapore
ABU Engineering Industry Excellence Award

Presented by Dr Javad Mottaghi, Secretary-General, ABU
Winner: Dr Ahmed Zaki Mohd Salleh, Media Prima, Malaysia
ABU Developing Broadcasters' Excellence Award

Presented by Mrs Sun Suchuan, Deputy Director General, Science and Technology Department, SAPPRFT/RPTRC-China

Winner: Permadi Kencono Wulan, RRI, Indonesia

ABU Broadcast Engineering Excellence Award

Presented by Mr Masakazu Iwaki, Chairman, ABU Technical Committee, Head of Human Interface Research Division, Science and Technology Research Laboratories, NHK-Japan Panel Chairman, Broadcast Excellence & Developing Broadcasters' Awards

Winner: Soonki Kim, KBS, Korea

Mrs Sun Suchuan was presented with a token of appreciation by Iwaki-san.

Then Mr Masakazu Iwaki led the delegates through the agenda, which was confirmed. The proceedings of the 2016 TC were approved. The Rapporteurs were confirmed as Mr Lindsay Cornell, BBC, and Mr Paul Treleaven, IABM.

3. Technological Inspirations

3.1 Reports of the Death of Broadcast TV Are Greatly Exaggerated

Dr Peter Siebert, Executive Director, DVB Project Office, DVB


Dr Peter Siebert

Dr Siebert said he was pleased to be invited and to talk on this subject. He noted that predictions about the demise of broadcast TV had been rather frequent, but not necessarily very accurate! But he also noted that predictions were difficult and instead he would offer some facts to give a picture of what was happening. He said he had been able to use the data from the EBU's MIS department to help him, so the results were strongly based on the European experience. Some headlines: The gap in TV viewing between old and young is growing; Online viewing is growing, i.e. more on-demand content (and this includes DVDs, YouTube, recorded TV, etc.); PSBs are the leaders in on-demand viewing; the TV set is the main screen for streaming (i.e. the big screen is preferred for video); all households have a TV and a smartphone; viewers spend a lot of time trying to find something they want to watch (almost 1 hour per day!!). He concluded that just because things change, does not mean that things disappear. For example, books have been with us a long time, and although they have changed, they are still with us. The message from the data is that TV will survive, but things will change. Providing good content that viewers want will be the key to survival: by reducing search time, we increase viewing time. Finally, Peter gave a quick update of what DVB had been doing for the past year, including UHD, hybrid with HbbTV, Targeted Advertisement, SatIP and IP delivery I-DVB.

3.2 UHD Regular Broadcasting in Korea


Mr Junsung KIM

Mr Junsung KIM, Deputy Director of Network Center, Korean Broadcasting System

Mr Kim informed delegates of the start of terrestrial UHD broadcasting on 31 May 2017, using the five 6MHz channels allocated in the 700MHz band by the Korean government. The technology used is ATSC 3.0. The UHD obligation is 5%, the rest being HD content. The basis of the service launch started in 2012 with UHD test broadcasts using DVB-T2. In March 2015, the Korean government announced start of UHD. In 2016, the trial switched to ATSC 3.0.

The roll-out of UHD was phased. Phase 1 was May 2017 in Seoul. Phase 2 was Dec 2017 with expansion to 5 major regions and the winter Olympics venue. Phase 3 is

to become nationwide between 2020-2021 then, in 2027 HD will close. UHD programming will increase by 5% per year until 2019, totalling 25% in 2020, 50% in 2023 and 100% in 2027.

To receive both UHD and HD, broadband antennas are needed. Because of the earlier DVB-T2 transmission, some TVs (approximately one million) are already in homes. These homes will need an ATSC 3.0 STB to receive the new UHD services.

A new platform is being built for UHD TV. This is in response to a reduction in consumption of DTT due to its lower content offer than e.g. cable. So, a new platform (Tiviva) will be launched to combine UHD and IP. The terrestrial UHD broadcasts will allow fixed UHD reception and mobile HD reception and will link seamlessly with IP services for enhanced search and interaction.

3.3 8K Broadcasting and Tokyo 2020

Mr Atsushi HARUGUCHI,
Head of Engineering Administration Department, Deputy Director-General of Engineering, NHK


Mr Atsushi HARUGUCHI

Mr Haruguchi said that 4K and 8K broadcasting has been introduced already in Japan. He noted that 8K is referred to as Super High Vision (SHV) in Japan. It has high colour gamut, 22.2 sound, and many features to make very realistic viewing and listening. For satellite, Channel 17 is in use for test 8K broadcasting, with channels 7, 8, 12 and 17 for 4K from 2018. Full 8K operation starts in 2018 using channel 14. Many broadcasting trucks and studios have already been set up for 8K content capture. 8K monitor screens up to 85" and cameras have been produced. 8K cameras are also being used by the film industry. The latest 3-chip 8K cameras have the same physical properties as current 2K cameras and many different 8K capable displays are coming into production. A 70" consumer LED 8K TV was available at around USD9000, but Mr Haruguchi-expected the price to fall, following the trend observed with 4K displays.

The two crew Rio Olympics experience had helped with the planning for the Tokyo 2020 games. In addition, further R&D projects were in train to enhance the experience, including synthetic speech and 3-dimensional information analysis for sports graphics. NHK was examining the opportunities for the emerging 5G standards for use with 8K broadcasting for content uploading. Finally, Mr Haruguchi showed the timeline for the 2020 Olympic Games.

4. Director's Report

Dr Amal presented the Director's Report. He said that he would like to highlight some specific activities, whilst all the details could be found in the written report. The ABU Technical Review contained many informative articles about developments in the ABU region and summaries of the activities of the Secretariat and other meetings and seminars.


Dr Amal Punchihewa

He noted that despite the difficult financial situation in the world, the ABU had continued to attract sponsorship for DBS and maintained a significant set of workshops and visitor numbers. Dr Amal thanked NHK STRL for hosting young researchers from the ABU membership to help spread advanced technology back to other members. The Technical Department contributes to other activities in the region in partnership with other organisations. Capacity building is also important, including digital radio, IBB and so on, and this has also been done in conjunction with ASBU. The Technical Advisory Service (TAS) had provided three missions in the last year, with 15 in discussion for the future. International Cooperation with sister Broadcasting Unions and international organisations, like ITU, WorldDAB, DVB, etc., had been renewed and consolidated over the year. Dr Amal thanked the TC Chairman, Mr Iwaki, the vice-chairmen, members, and all those who had contributed to the year's success: including the Technical Department team.

5. Bureau Proposals

There was one recommendation from the transmission topic on 'Requirements of Closed Captions and Subtitles Systems'. Members were asked to study this recommendation by and to provide any feedback by the end of November 2018. There would also be opportunity to provide comments during second day session. Dr Siebert informed delegates that DVB has finalised the subtitles specification, including XML and bitmapped representations.

The Technical Bureau, elected by ABU members, discussed strategic issues in its last mid-year meeting. Five areas had been identified, and each had a number of subtopics. The TB had created a grid detailing the issues and would send a questionnaire to allow all members to provide their feedback so as to create the priorities for the Technical Department to facilitate. Dr Amal Punchihewa highlighted that the member response was very important and encouraged all to participate.

6. WRC-19 Preparations


Mr Pham Hai

Mr Pham Hai, Counsellor ITU-R Study Groups, Radiocommunication Bureau, ITU, stated that it was a great pleasure to be present at the ABU TC. He introduced the ITU as a UN special agency, with 193 countries participating and the responsibility to allocate global spectrum and satellite orbits, to develop technical standards and to coordinate activity. The WRC objectives were to create regulatory certainty and to develop global spectrum harmonisation – not an easy task! He described the WRC cycle, from one WRC to the next; how the outcome of one WRC leads into the next WRC, via the CPM-1, study groups, CPM-2, and RA. Other paths are also involved, from the Radiocommunication Bureau, for example.

There was a growing trend that the regional positions presented by different groups – APT, ASMG, ATU, CEPT, CITEL and RCC – were speeding up the process of agreements.

The WRC-19 agenda is set. There were no agenda items related to SG6 (Broadcasting) following the WRC-15 decision not to change the broadcast bands before WRC-23. Broadly speaking, there are 7 groups of topics: Broadband applications in the MS, Other LMS and FS systems and apps, New Transport Systems in the MS, Maritime issues, Aeronautical and Amateur services (Region 1 only), Science issues (e.g. weather, short duration satellites <3 years), Satellite issues.

More details had been provided for the satellite issues, because these were the most relevant to broadcasting.

The meeting schedule for the ITU and regional groups was presented.

For WRC-23, preparation was already underway. In particular, attention was drawn to Res. 235 concerning the band 470 to 960 MHz.

Mr Pham stressed that while there were no direct agenda items related to broadcasting, it was not a time to sleep – late items have previously appeared, and there are agenda items that affect spectrum adjacent to broadcasting, too.

7. Strategic Issues

Session Chair: Mr Tharaka Mohotti, MTV-Sri Lanka and Vice-Chairman, ABU Technical Committee

Mr Tharaka Mohotti

7.1 IP for Media – Standards and Interoperability

Mr Paul Treleaven, Technical Consultant, IABM

Mr Paul Treleaven

Mr Treleaven explained how the IABM had helped to bring IP into the broadcast sphere. He said there were three main areas for IP in broadcast. What was important was interoperability. The Joint Taskforce on Networked Media (JT-NM) is an important player in the interoperability space, providing a roadmap starting in 2014 and running up to 2020 for the transformation from SDI to cloud-based IP environments.

SMPTE ST 2110 is the most important standard driving forward this work. It is divided into several parts, dealing with various issues, such as timing, video, audio and ancillary data. The main parts are already ready, with others coming soon. These parts are based on previously existing standards including ST 2022-6 and AES-67.

Other specifications are also needed to build complete systems. Under the Networked Media Open Specifications (NMOS), there are specs for discovery and registration (AMWA IS-04). This was used at the interoperability demonstration at IBC2017. A fully live production system using ST 2110 was set up. 91% of IABM members will be supplying ST 2110 equipment by Q2-2018, so this technology seems to be ready.

7.2 Approach to Media Cyber Security by NABA, EBU, ABU and WBU-TC

Mr John Lee, Vice-President, North American Broadcasters Association

Mr John Lee

Mr Lee provided a brief review of cyber security across NABA, EBU, and WBU TC. IP based networks allow a close connection with end-users, but they also introduce security risks, including the downfall of entire broadcasters. NABA first addressed the issue with the Risk Awareness and Continuity Committee (RACC) and hosted a conference in 2016 on cyber security. NABA has a sub-committee for cyber security to assist all its members in their dealings with IP networks, software decisions, etc. Network architecture needs to consider not just speed, but also security. Mr Lee said that the EBU was the first organisation to get to work on cyber security, and has produced six recommendations in recent years, covering all aspects including malware, denial of service, connected TV issues, etc. The WBU TC has also created a cyber security sub-committee, bringing the expertise of the broadcasting unions together. This had produced a new recommendation, expected to be published early next year that would help broadcasters to evaluate suppliers against the cyber security issues.

Mr Lee outlined the steps to basic cyber control or cyber hygiene. Simple steps like inventories of hardware and software, installing patches within 30 days of release, identity management, multifactor authentication and control of privileged account holders.

The broadcast industry is rapidly adopting IP, but this could leave them open to hacking and other threats, some of which have already been seen. This, in turn, could lead reputational damage, asset theft, revenue issues, etc.
Mr Lee emphasised that all broadcasters need to consider cyber security and dedicate resources to ensure that their organisations are covered.

7.3 EBU-flow, a multi-CDN Project

Mr Simon Fell

Mr Simon Fell, Director Technology & Innovation, European Broadcasting Union

Mr Fell said that traffic to different platforms is increasing, and the risk was higher costs. Traditional broadcast platforms had a fixed cost, but with on-demand, the costs rise in proportion to success. EBU analysis showed that different approaches were already in use by members, from commercial solutions to in-house. Changing providers was seen as a huge issue. But for cost control, a more sophisticated approach was needed. Different metrics could be used for load balancing

and knowledge of what, where and when can give a better negotiating position with suppliers. But there were other advantages too – by having multiple CDNs failure of one could be compensated by the others, giving greater resilience. The EBU had set up a pilot multi-CDN with six EBU broadcasters on board and three CDNs. EBU members were providing about 20% of their CDN traffic to the EBU pilot, using their own deals for the rest. The plan was to move the pilot to a Eurovision service in the future.

7.4 DTMB Technology Evolution and Promotion


Dr Li Leilei

Dr Li Leilei, Professor, Academy of Broadcasting Planning, Radio and Television of the People's Republic of China (RTPRC-China)

Dr Leilei provided an overview of Chinese DTV showing the broadcasting chain. Distribution and transmission includes satellite, terrestrial and cable methods. China decided in the 1990s to develop a DTT standard, which led to the DTMB standard in 2006, also later as ITU-R recommendation BT.1306 System E (DTMB-Advanced) in 2015. DTMB is the mandatory standard in China. It employs various unique features to take advantage of wide spectrum usage, and robustness. By the end of 2012, 337 cities were using DTMB. In 2015, the central Wireless Coverage Project provided the 12 core TV channels nationwide. There are 10726 transmitters. DTMB has also been tested in South America: in 2007 and 2009 in Cuba and in 2008 in Columbia and Peru, and in 2009 in Ecuador. Cuba adopted DTMB in 2013 and now has 70% land coverage. DTMB has also been promoted in Laos (2012) and Cambodia (2016). Overall, 9 countries have adopted DTMB with several already operating.

8. Members' Present


Dr Kong Bin

Session Chair: Dr Kong Bin, Operation Director/Senior Engineer, Academy of Broadcasting Planning, SAPPRFT, PRC and Vice-Chairman, ABU Technical Committee

8.1 Radio on TV


Mr CW Leung

Mr CW Leung, Head/Engineering, Radio Television Hong Kong

Mr Leung explained that as the PSB in Hong Kong, RTHK has 7 radio and 3 TV channels. Some radio shows have content that is also suitable for TV viewing and RTHK have investigated the process to put radio on TV. Part of the aim was to bring TV audiences to radio programmes. The content creation system included online content storage. To enable the project, IP connectivity was needed to and from the radio broadcast centre. Control paths were needed to control the cameras and equipment. Currently, the video core is still SDI based, but it is planned to move to all IP later. For mobile news gathering, 4G mobile network is used. It is quick to set up and economical, but the quality is not guaranteed, so it is not always available. There is integration with social media, providing cost effective output. The TV production is integrated into the radio production process. Some of the challenges included video walls, to provide instant backdrop changes, and space constraints because radio studios are small – robotic camera arms have been used. Visual control desks have been squeezed into the radio production galleries. The use of virtual servers has also helped with space issues. Acoustic design challenges have been to keep the good radio acoustic despite the addition of display screens and so on – a new acoustic ceiling treatment had also been developed. Through this project, some synergies between the radio and TV production had been realised, sharing assets and equipment. The last element is augmented reality enhancement, which can be used to make the small radio studios look much bigger. Further work is planned to make the systems more robust and at the same time make the operations of RTHK more cost efficient.

8.2 Integrated China Digital Radio (CDR) System


Mr Gao Peng

Mr Gao Peng, Director, Academy of Broadcasting Science of SAPPRFT

Mr Gao described Convergent Digital Radio, explaining why, despite all the existing digital radio standards, China had developed its own solution. The main features are a flexible changeover for FM analogue radio, by using flexible spectrum occupancy based on 100kHz sub-bands, building to 800kHz, and a hybrid mode with analogue FM. Starting with FM+1 sub-band (split 50+50kHz digital), could then go to 2x100kHz sub-bands or even 4x100kHz sub-bands. The system has 3 transmission modes, three modulation levels and three data channels. Mr Gao said that with its different channel coding modes, CDR provides a 2dB advantage over DRM.

CDR has been released as Industrial standards in 2013 and was submitted to the ITU-R for an update to ITU-R Rec. BS.1114 as a new digital radio system.

In terms of digital roll-out, 563 transmitters will be built for CDR – many having been already installed. The standards will be released and developed, along with release of receivers and further network roll-out.

8.3 Mediacorp New Campus


Mr Peh Beng Yeow

Mr Peh Beng Yeow, Vice President, Mediacorp-Singapore

Mr Yeow explained how Mediacorp had relocated to its new broadcasting facility, concentrating on the design considerations. The project started in 2011 and had four phases. The new building was green – energy efficient. Important elements were the heating and ventilation system. Mediacorp had used a shared approach with other local companies. Carbon dioxide sensors were used to regulate fresh air into the

building and CO monitors maintained health in the basement carpark. UV emitters were used to control surfaces and so on to reduce micro-organisms.

Lifts were regenerative, saving 30% energy and escalators had motion sensors. Bicycle storage encouraged cycle use. LED lighting was used extensively, saving power and reducing A/C load as they ran much cooler. Timers were also used to reduce power in unused areas. Natural light wells were designed into the building to increase natural light and photocells were used to control lighting to optimum levels . Window glass was designed to reduce heat transmission into the building, again reducing the A/C requirements. Additionally, water was controlled so that potable water was only used for drinking and recycled water was used for toilet flushing, etc.

Construction also applied environmental techniques; for example, minimising cement usage, and cleaning water before discharge.

8.4 Emergency Warning System (EWS)

Mr Anoop Kumar Pandey, Rep of DVB, Senior Chief Engineer, Samsung India


Mr Anoop Kumar Pandey

Mr Pandey explained the DVB work item related to EWS, designed to provide the mechanisms for distribution of information to assist with emergencies. DVB has always had a basic system, but this was audio only. The new project aimed to provide a system for all, including hard of hearing, for whom radio was a problem. DVB started the project in 2017 and reviewed all existing EWS systems, conducting surveys with ABU and EBU, members to identify important features. The number one feature was 'wake-up from standby'. Geographical control was also very important so that only those affected by a disaster would be alerted. The commercial requirements having been agreed, the technical design would now start.

In the ABU region, the ISDB-T countries have their own system, which has been working in Japan for some years. In the DVB countries, this DVB – EWSv2 system will help. Most already have early warning systems, but not integrated with DVB-T; An exception is Indonesia, which has a proprietary system.

8.5 MPEG-H Interactive and Immersive Audio for Broadcasting


Mr Toni Fiedler

Mr Toni Fiedler, Director APAC, Fraunhofer Institute for Integrated Circuits

Mr Fiedler described the idea of 3-D audio, with high speakers, middle speakers and low speakers to give a more realistic sound. Fraunhofer also works on sound bars for locations where many speakers are not possible. Object audio coding is also involved, allowing a different way to mix the channels for the listening situation, as is metadata. The idea being that the same audio stream can be customised for home theatre, the gym, a tablet, etc. MPEG-H is the core of this approach. In Korea, MPEG-H is in use with the UHD ATSC 3.0 broadcasts. In China, MPEG-H is a candidate system for future broadcasting.

New equipment is needed for working in the 3-D audio environment. To support MPEG-H, a support and licensing regime is being developed which will bring confidence to the market. Standardised test suites are being created to allow products to be tested fully and easily. There is a new logo associated with this work.

8.6 5G in Broadcasting and Media


Dr Fares Lubbadeh

Dr Fares Lubbadeh, Owner, Director General, SpaceTech TV Engineering

Dr Lubbadeh explained that a significant development recently was the rise in mobile video viewing. Mobile phone technology has evolved from voice only (analogue) to the current smart phones. But before that, radio telephones had been installed in vehicles as early as the 1940s. 2G started in the 1990s and was digital, allowing the expansion from voice to data, although at very low speeds. In 2001, the launch of 3G allowed video, web access, etc. 4G arrived in 2011, featuring an all IP approach. With higher data rates, many new ideas were made possible. 5G is planned for launch in 2020, promising higher bandwidth, higher data rates, lower latency, lower power consumption, etc. All things will be possible with 5G – enhanced mobile broadband, Internet of Things, autonomous vehicles, etc. So, the millimetre wave (>6GHz) spectrum is needed.

The foundation of 5G is 4G. The 3GPP project is developing 5G, but there is currently no standard. Requirements exist and a lot of development is proceeding.

The EBU has produced a new report about 5G which states that 5G will bring benefits to broadcasting, though benefits may be more for on-demand delivery rather than "traditional" broadcasting.

8.7 Challenges in the Broadcast Media (Malaysian Perspective)


Dr Ahmad Zaki Mohd Salleh

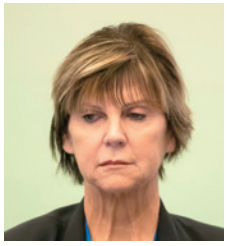
Dr Ahmad Zaki Mohd Salleh, Director of Technical Operations, TV Networks Media Prima Berhad

Dr Ahmad Zaki explained that changes in society were leading to necessary changes in media. Changes in technology meant that more was possible at lower cost. What does this mean? People still love TV, but the money is moving away from traditional broadcasting. People like a big screen, but they also want on-demand. Good content is still essential; revenues need to be diversified; costs must be controlled. The typical life cycle of a broadcast service is that starting off costs are low and

revenue is good. Gradually costs rise faster than revenues and a cross-over point arrives. So changes must be made. The longer a broadcast service runs, the less innovative it tends to be. So change agents are needed in the workforce.

Digital TV offers a lot of innovation possibilities – better audio and video, hybrid, etc. But simulcast periods are challenging. In parallel, the audience expects to view on many different devices and the content may have to go via many third party portals. All of this presents many challenges.

8.8 Challenges beyond Technology in Rolling out Digital Radio in APAC


Ms Joan Warner

Ms Joan Warner, CEO, Commercial Radio Australia and Vice President of WorldDAB

Ms Warner explained that after careful and extensive investigation, Australia had chosen DAB+ to digitise radio. But beyond the technical decision, there were many other challenges to going digital. FM spectrum was crowded, AM spectrum was too noisy, so new spectrum was needed together with technology to provide a wide range of receivers. But there was also the question as to who has access to the spectrum – was it the broadcaster or some third party. In Australia, the broadcasters had the license for AM and FM and also got that for DAB+. One challenge for roll-out was the costs of simulcast. DAB+ allowed brand extension into new content proposals, so a well-loved station could offer additional niche stations to extend their reach and revenue. Costs for digital were much lower than analogue and experience has shown that DAB+ transmission in Australia costs 10% of the cost of FM transmission. One challenge is to help the audience understand what the new technology will offer, and that needs careful planning. Technology is only one aspect of rolling out digital radio.

Welcome remarks for the second day of the ABU-TC were given by the Chairman Mr Masakazu Iwaki

The Keynote Presentation titled "Technology Scheme and Practice of CCTV Media Convergence" was delivered by Mr Mei Jianping, Director, RTPRC-CCTV.

He said there was convergence between all forms of services – beyond one-way television. The converged solution he presented uses existing television production infrastructure, plus public and private cloud. It is called "One cloud, multi-screen". CCTV.APP was presented as a unified app. He said that roll-out commenced in June 2016 onwards on a region-by-region basis. In the area of Big Data, analysis of usage data helps personalised recommendations.


Mr Mei Jianping


Mr Akira Negishi

Mr Akira Negishi of NHK presented NHK's Broadcasting Technology Research Scheme for ABU 2018.

The scheme entertains young members for 3-12 month research appointments. There are six areas of STRL research viz., 8K; 3D; Internet services; Advanced Content Production; User friendly technologies and Devices/materials for Next Generation broadcasting. More details are available on the STRL website and the ABU website may be referred for application information.

This year the Technology Panel had the theme of Media4All and the panel was Moderated by Dr Amal Punchihewa, Director Technology & Innovation, ABU.

In his introduction, Dr Punchihewa mentioned the prime goal was to assist people with impairments.

The Panel Team comprised Mr Masakazu Iwaki, Chairman, ABU Technical Committee, Mr Abdelrahim Suleiman, Director General, Arab States Broadcasting Union, Mr Simon Fell, Director Technology & Innovation, European Broadcasting Union, Mr John Lee, Vice-President, North American Broadcasters Association, Dr Peter Siebert, Executive Director, DVB Project Office, DVB and Ms Joan Warner, CEO of Commercial Radio Australia and Vice Chair of WorldDAB.

Mr Simon Fell talked about the AVMS directive in Europe and European disability forum. He said work had advanced in the UK, including subtitles, audio description, signing quotas.

Mr John Lee mentioned that long-standing work on closed captions. Back in early '90s, captioning had been used to learn the English language.

Dr Amal Punchihewa reminded of the speed-of-speech adjustment researched by NHK Science and Technology

Research Laboratories, STRL. He noted that five hours of audio description services per day were required as per legislations. Mr Iwaki gave a full account of accessibility service requirement up to last year and said that those would be revised for 2018 and over the next 10 years.

Mr Abdelrahim Suleiman

Mr Abdelrahim Suleiman said that the Arab States were unfortunately a bit behind. But he said they were formulating a plan. Dr Amal Punchihewa commented that the ASBU region may have an opportunity to leapfrog.

Ms Joan Warner said accessibility was quite well regulated in Australia. There were additional services of newspaper reading on radio. Also, DAB+ had rolling text and a there was "Bed-shaking" research for emergency warnings. Also, one-button DAB+ radio for impaired.

Mr Masakazu Iwaki said there were 300,000 visually impaired and 350,000 audible impaired persons in Japan. The Ministry had produced a 10-year guideline for access services; Year 2017 is the last year of the previous cycle and Japan has almost reached the target. There were difficulties with closed captions to be provided for live programmes. In Japan, 3000 character support is needed (2 byte character codes). The new guideline for next 10 years will tackle the challenge for live broadcasts.

Dr Amal Punchihewa said that he had researched the situation in NZ – and that all non-live programmes are subtitled there.

Dr Peter Siebert observed that DVB has subtitles and signalling audio channels for the visually impaired. Next Generation Audio AC4 or MPEG-H has objects, so it would be possible to remove background noise to improve understanding. Companion Screen and Services using HbbTV, available next year, will provide the necessary sync info for assisted content over broadband.

Mr Simon Fell talked about speech recognition – re-speaking by trained voice. Machine learning BBC work had fed 6000 hours into the system which was now very good at doing multi-accents.

Mr John Lee said that a variety of work now made it quite easy to provide subtitles, even for live production.

Mr Masakazu Iwaki said that, with the enforcement of broadcast legislation it was required to correct subtitle errors Avatar was being used for signing of live television programmes, especially weather forecasts.

Ms Joan Warner said she expected to see some voice-to-text services. But there is no regulation in Australia for digital radio to provide this.

Dr AMAL Punchihewa proposed that the broadcasting unions share information on accessibility and work with ABU-TC on this topic.

Mr Masakazu Iwaki, Chairman, ABU Technical Committee Chaired the topic summary presentation session.

For the summary and full details from Topic Area Chairmen, please see the Production, Transmission, Spectrum and Capacity building reports.

Mr Alexander Zink

Mr Alexander Zink from Fraunhofer Broadcast Applications presented the topic of CODECS and Royalties in the Radio Study Groups, Standards and Implementations session. He outlined some earlier developments that Fraunhofer had achieved. xHE-AACX other end of spectrum to MPEG-H. He said that this had already added to the DRM system specification and is already on-air in India. xHE-AACX dramatically improves data consumption over mp3 downloads. It works for 2G and functions between 128kbit/s down to 16kbit/s.

To the question of "What about revenue for contributor that doesn't make products?", he replied, "Royalties under licence – VIA licensing maintains AAC family."

Mr Lindsay Cornell

Mr Lindsay Cornell, Principal Systems Architect, British Broadcasting Corporation, presented ETSI – DRM/ DAB+. In DAB technology, he talked about Migration to DAB+. Some changes to provisions in original 1995 standard – v2 were drafted. It is still compatible though 100 pages shorter. Guide TR 101 495 had been published and included a TPEG specification.

There were no major changes DRM.

Mr Cornell also mentioned that in preparation for switchover to digital radio, a new document on minimum requirements for DAB had been published, including standards for both transmitters and receivers.

The Host Presents session was on Media Convergence and was moderated by Mr Sheng Zhifan, CTO, Academy of Broadcasting Science of SAPPRFT, RTPRC-China.

Presenters:
Ms Wang Pei, Senior Engineer, RTPRC-CCTV presented 4K UHDTV Standard Research and Technical Test. She said it started with government planning for 4K, involving a 6 stage strategy. There was a study of 4K UHD Standards. UHD E2E Standard. 4 parts; AVS2, UHD parameter (published), HDR (in progress, constrained parameters).

For Content Production and Technical Facilities there would be a hybrid period of HD+4K and there was a plan for a 4K EFP system for 2018 games.

The Shanghai Media Group, (SMG) had carried out a 4K delivery test.

Mr Zhang Shenwei, Senior System Engineer, RTPRC-SMG presented on Making a Change: First Through Media Convergence Production.

CNR has 13 radio broadcasting frequencies guided by the government. SMG has rolled out social media app "Archimedes" for audio convergence. There are several sub-apps under "@radio". This is the converged media solution.

Multiple thread production is being introduced via cloud. Introduction of "central kitchen" for co-operative production rather than resource silos.


Mr Sheng Zhifan

Mr Sheng Zhifan, CTO, Academy of Broadcasting Science of SAPPRFT presented TV Operating System (TVOS) for Smart TV Terminals in the Era of Media Convergence. Background is needed to make change by expanded delivery methods. Evolution is towards IBB terminals.

Presentation covered Service and OS requirements (conclusion is to use TVOS, developed by SAPPRFT), Architecture and Function, Development and Deployment.

There was a question from audience about TVOS; Is it optional or mandated? It was answered that for operators it was required, but for End User Equipment (EUE) it was optional.

To another question, "Are you happy with all-IP?" the answer was, "So far, so good!"

A new Recommendation, Subtitling was approved


Mr Utpal Kanti Mandal

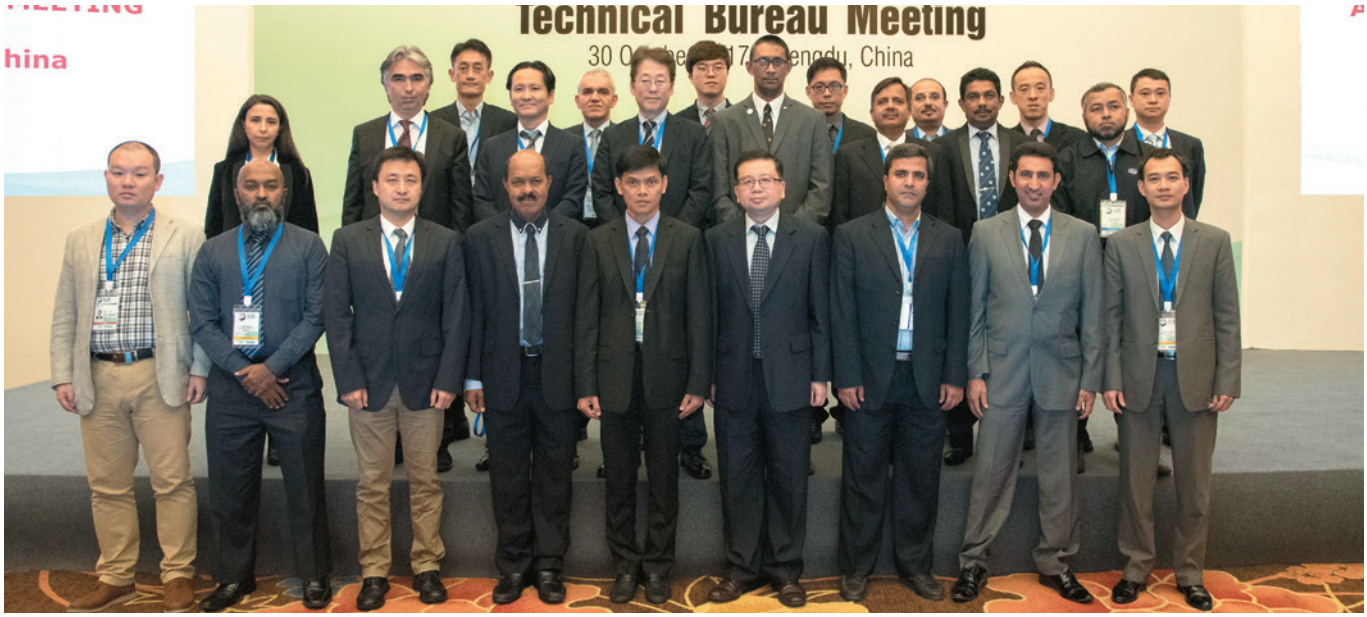
During updates from Sister Unions & Intl Organisations, AIBD – Mr Utpal Kanti Mandal, Programme Manager-Broadcast Engineer, Asia-Pacific Institute for Broadcasting Development. EBU, NABA, ITU, WorldDAB, DRM, ITU, DVB briefly introduced their organisations.


Ms Tupoutua'h Baravilala

During announcements of upcoming ABU Events, Ms Tupoutua'h Baravilala, Principal Legal Officer Office of the Attorney-General and Ministry of Communications, Fiji, invited audience to the ABU Media Summit on Climate Change and DRR & 9th Pacific Media Partnership conference, to be held in Nadi, Fiji from 5-7 February 2018.

In closing Mr Masakazu Iwaki, Chairman of ABU-TC thanked and presented a token of appreciation to host of this meeting round. He also thanked all the contributors. He concluded by informing the ABU-TC that the next meeting would be held in Turkmenistan.

Mr Iwaki – presenting a token of appreciation to Ms Sun



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2 February 2018

ABU ENGINEERING AWARDS 2017

ABU Engineering & Technical Awards 2017

ABU Developing Broadcasters' Excellence Award

Andi Permadi
Head of New Media
Radio Republik Indonesia

The winner of the 2017 ABU Developing Broadcasters' Excellence Award was Mr Permadi Kencono Wulan, Head of New Media of Radio Republik Indonesia (RRI). Mr Permadi won the ABU Developing Broadcasters' Excellence Award for his contribution to new services of RRI. Mrs Sun Suchuan, Deputy Director General, Science and Technology Department, SAPPRFT/RPTRC-China presented the award to Mr Rahadian Gingging, Director of Technology and New Media, Radio Republik, Indonesia who accepted the award on behalf of Mr Permadi.

ABU Broadcast Engineering Excellence

The winner of the 2017 ABU Broadcast Engineering Excellence was Mr Soonki KIM, Executive Managing Director, Production Technology, Korean Broadcasting System who won for his outstanding contributions to implementation of ATSC 3.0 based Digital Terrestrial Transmission. Mr Masakazu Iwaki, Head of Human Interface Research Division, Science & Technology Research Laboratories, NHK-Japan and Chairman of the ABU Technical Committee presented the award to Mr Doo-Hyung Kang, ABU Technical Liaison Officer, Korean Broadcasting System who accepted the award on behalf of Mr Kim.

Soonki KIM
Executive Managing Director
Production Technology
Korean Broadcasting System

2017 ABU Engineering Industry Excellence Award

The winner of the 2017 ABU Engineering Industry Excellence Award Dr Ahmad Zaki Mohd Salleh, Director of Technical Operations, TV Networks, Media Prima Berhad, Malaysia for his outstanding contribution to broadcast media. Dr Javad Mottaghi, ABU Secretary-General presented the award to Dr Ahmad Zaki.

ABU Green Broadcast Engineering

There were two winners for the **2017 ABU Green Broadcast Engineering, Mediacorp-Singapore and CCTV-China.**

Mediacorp-Singapore was award for environment friendly new broadcast centre and CCTV-China was awarded for converged production cloud platform. Mr Hamid Dehghan Nayeri, Director, International Technical Affairs, IRIB-Iran Panel Chairman, ABU Industry & Green Awards presented the awards to Mr Peh Beng Yeow, Vice President (Transmission) who accepted on behalf of Mediacorp and to Mr Cui Jianwei, Deputy Director, Technical Production Center who accepted on behalf of CCTV.

Best Article Award

The winner of the Best Article Award for 2017 was titled Impact of Interference on Broadcasting Satellite Services in Terms of Increase Rate of Outage Time Caused by Rain Attenuation authored by Dr Kazuyoshi Shogen, B-SAT-Japan, Mr Masashi Kamei, Japan Telecommunications Engineering and Consulting Service-Japan, Mr Susumu Nakazawa and Mr Shoji Tanaka, NHK-STRL-Japan.


Mr Masashi Kamei


Mr Susumu Nakazawa


Mr Shoji Tanaka

Dr Kazuyoshi Shogen, VP (International Affairs), Corporate Planning Division, B-SAT (Broadcasting Satellite System Corporation) accepted the award on behalf of the authors which was presented by Mr Sheng Zhifan, CTO, Academy of Broadcasting Science of SAPPRFT/RTPRC-China.

Commended Article Award 1


Mr M S Duhan
DDG (E), Doordarshan Directorate General, New Delhi

The winner of the First Commended Article Prize was awarded to Mr M S Duhan of Doordarshan-India for the article titled Structural Mechanics of TV Towers: Strengthening for Hauling up of Additional DTT Antennas. Mr Sheng Zhifan, CTO, Academy of Broadcasting Science of SAPPRFT/RTPRC-China presented the award to Mrs Supriya Sahu, Director-General of Doordarshan and ABU Vice-President.

Commended Article Award 2

The Second Commended Article Prize was awarded to Dr Li Leilei, Professor of the Academy of Broadcasting Planning, RTPRC-China for the article titled WRC-19 Agenda Items Concerning Broadcasting Service and ABU Spectrum Issues. Mr Sheng Zhifan, CTO, Academy of Broadcasting Science of SAPPRFT/RTPRC-China presented the award to Dr Li Leilei.

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4th ABU-AIBD Regional Workshop and Training Course on Engineering Fundamentals for Broadcasters

4th-8th December 2017, Kuala Lumpur, Malaysia

This workshop aimed to provide basic engineering fundamentals for broadcast engineers and technologists who are at the beginning of their careers. The workshop facilitated participants to learn about the current trends and advancements in broadcast technologies. It also focused on fundamentals of IT, audio and video systems, engineering techniques and applications. In the feedback session the participants responded that the knowledge gained would help them to build confidence in operating in an evolving media value chain.

Among main objectives, the topics participants should be able to explain and apply in their work included; Basics of Audio and Video, Concepts of analogue to digital signal conversion; Signal processing in the media value chain; Multiplatform delivery and Quality of Experience; Converged media-IT-broadcast environment; Radio and TV transmission concepts, techniques and technologies and Evolving media and delivery platforms.

Thirty seven (37) participants from ten (10) countries representing 19 organisations benefited from this latest in a series of capacity building events that ABU has been carrying out in collaboration with AIBD for the last three years.

ITU/NBTC Conference on Digital Broadcasting

12th December 2017, Bangkok, Thailand

The International Telecommunication Union (ITU) and the National Broadcasting and Telecommunications Commission of Thailand (NBTC) organised a Conference on Digital Broadcasting on Tuesday 12 December 2017 at Century Park Hotel Bangkok.

The conference achieved its aim of sharing knowledge and experience of the works jointly done by ITU and NBTC on Digital Broadcasting including digital terrestrial TV broadcasting, digital radio broadcasting, and community TV broadcasting. Broadcasting practitioners and policy makers from APAC and ASEAN Member States attended the conference and exchanged their views including their experiences in digital broadcasting deployment.

Over a hundred and twenty participants from Asia-Pacific countries, representing a wide range of broadcast related organisations shared information based on their experiences. ITU, NBTC and ABU highlighted outcomes from various studies they have carried out. ABU also presented updates on technological and global trends.

ITU/NBTC Workshop on Digital Radio Broadcasting Trial

13th December 2017, Bangkok, Thailand

The International Telecommunication Union (ITU) and the National Broadcasting and Telecommunications Commission of Thailand (NBTC) organised a Workshop on Digital Radio Broadcasting Trial on Tuesday 13 December 2017 at Century Park Hotel Bangkok.

The workshop achieved its aim of sharing knowledge and experience of the work jointly done by ITU and NBTC on Digital Radio Broadcasting, including masterplans, business models, digital radio broadcasting trails, and community TV broadcasting. The broadcasting practitioners, academia, broadcasters and policy makers from APAC and ASEAN Member States also exchanged their views and experiences of digital radio broadcasting planning and deployment.

Over hundred participants from Asia-Pacific countries, representing wide range of radio broadcast related organisations shared their experience and information. ITU, NBTC and ABU highlighted outcomes from various studies they have carried out. NBTC is a member of ABU who joined ABU in 2013 after some initiatives around digital radio broadcasting activities in Hanoi, Vietnam.

International Broadcasting Convention (IBC) 2017

By **Ms Kiymet Erdal**
Chief Engineer,
Turkish Radio Television Corporation

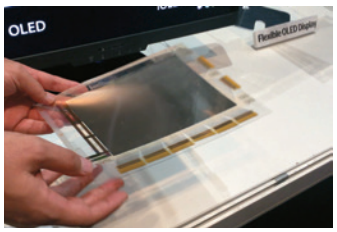
First of all, I would like to thank to ABU and TRT for giving me the chance to attend this great event in its 50th anniversary. The IBC conference gave me the chance to witness the hot technical discussions of today and future technologies, with very valuable speakers from the industry all over the world. The exhibition halls, future zone and future reality theatre were the visual side of what you could hear in the conference sessions.

It was a big show with more than 56,000 people (visitors, exhibitors and contributors), many things happening in each corner of the RAI centre, such as the conference programme with paper sessions, tech talks, advances in technology, future platforms, forums, etc; the exhibition halls with brand new technologies of manufacturers, new solutions for production, measuring, monitoring and control of network sources, implemented infrastructures, OB trucks, future zone with eye-catching future projects, IP Showcase etc.

In between the conference rooms, halls and the booths the topics mainly discussed, which I was very interested in, involved IP networks, Cloud production, augmented TV, VR, AR, MXR, machine learning, and artificial intelligence AI, viewer attraction and content variety on different platforms.

It is apparent that software is replacing hardware, operations are migrating to the cloud; production, distribution and archiving are changing from local to virtual operation. IP and cloud are important components of the future broadcast infrastructure. These new technologies are changing the state of the industry, the projects in R&Ds and then the success stories.

In the future zone, the focus was on multi sensory virtual worlds and imagery of the future. Technologies like mixed reality, 3D audio, object-based audio production, flexible OLED display, 8K Super Hi-Vision system, holographic projections etc., that will affect our lives in our living rooms in the very near future, were interesting and impressive.



Existing technologies like UHD, HDR, Dolby Atmos are attracting viewers. Inevitably, TV experience is transformed and with enhanced entertainment experiences like voice control, home robotics, e-commerce and audience engagement is aimed.

Innovations and new technologies turn into life changing developments. The new developing technologies will be used to give a different experience and will give new opportunities especially for sports fans. These challenges transform into different business models and content production. For instance when talking about Artificial Intelligence and machine learning content production, sports especially, will change. Metadata creation, smart search, facial recognition, intelligent clipping and speech to text applications for subtitling, seem to affect whole production chain. Object based audio offers a totally different experience and EBU is promoting OBA for use by broadcasters that it will allow multiplatform distribution and consumption of the programme, enable personalisation and access services and keep costs down.

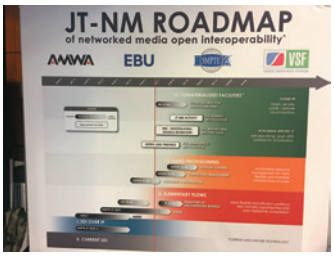
Interviews made with robots, Sophia and Professor Einstein, were impressive and we must face that the robotics and AI technology, the science and creativity, is approaching the media industry fast.

Implementing new IP techniques and technologies, moving the workflow from SDI to IP based networks while preserving the SDI baseband video quality, the broadcasters need to introduce new solutions, think about integration into existing architectures taking advantage of the benefits those IP solutions bring.

New ways of thinking will be required as the workflow, both for live and pre-produced content, becomes more IP-focused and content is handled in the cloud and physical interfaces are removed in favour of IP transmission and connectivity. The adaptation to operations will take time.

With the existing standards there are already some IP connectivity applications in use; for inter networking streams and capturing time relations between them, SMPTE ST2110 final draft is also ready here. In the IP showcase the demonstration, with nearly 50 vendors showed that IP production, playout and contribution is becoming a flexible and practical reality with interoperability based on SMPTE ST2110.

SMPTE ST2110 standards provide tools to enable companies



to move the workflow from SDI to IP based networks while preserving the SDI baseband video quality. By separating video essence from audio and metadata information broadcasters can build more agile and efficient IP based workflows. It was a good opportunity to see the systems running behind the scenes while listening the tech-talks and presentations from the experts.

In optimising the production workflow, especially for remote production and live contribution using IP networks, bandwidth reduction is required; reducing complexity of operations, reducing storage costs, lower cost network infrastructure especially for 4K and 8K workflows where more video streams, higher frame rates, higher resolutions is needed, the work on new codecs is essential.

The technical need for application-specific improvements and for commercial purposes, new coding tools and codecs are on their way. It is announced that the next generation video compression for video over IP JPEG-XS is to be published in 2018.

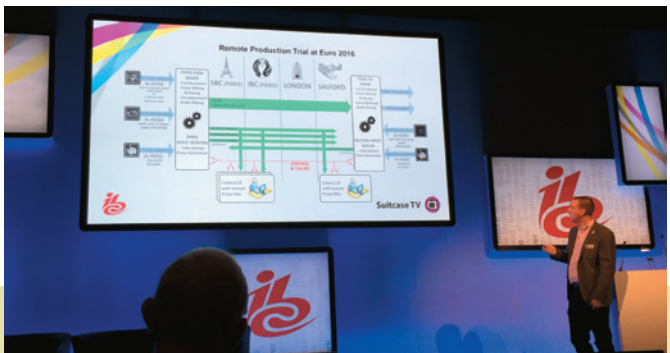
IP 4K/UHD and HDR OB Trucks with IP production switchers, IP multiviewers with IP infrastructure technology attracted visitors. The set-up allows us to work with audio and video separately within IP workflow based on VSF TR03.

I also visited some audio specialists' booths regarding my responsibility in my company, mixing consoles, wireless systems; IEM, intercom, monitoring and commentary systems are providing AoIP solutions with Dante, Ravenna and AES-67. Audio seems to be ahead of video in IP domain as 1 Gb ports are successfully used, unlike the video equivalents.

Broadcasters need simplified SDI/IP workflows and support during the transition to IP. This is another big step for the broadcast infrastructure to be planned in more efficient and flexible way. Hybrid solutions will play an important role during transition. The automation and advanced control systems technologies will also help to improve efficiency and reliability. As the control of systems becomes more widespread, complex operations will become simpler.

Remote production over IP networks with low latency will be beneficial for central, practical and low cost production. File based procedures and automation are still important topics with efficient solutions from different vendors.

Last but not least a special invitation only C-Tech Forum 5G was held. We, the broadcasters, should keep an eye on the impact of 5G on the broadcasting industry to benefit from the technology and become prepared for the possible threats.



Performance Analysis of DVB-S2 Using Matlab

abstract

DVB-S2 incorporates advanced error correction techniques with Low Density Parity Check (LDPC) coding that enables the transmission of 8PSK over noisy channels. Direct to Home (DTH) delivery of HDTV which requires very high bit rate has become a practical proposition. This paper describes the use of Matlab software to examine the signal flow process and performance under different configuration modes. It is also an update of a previous paper which was published in the ABU Technical Review in 2010. The present paper also examines the techniques by which the software can be adapted by both the practitioner and academician in the laboratory as field testing of satellite TV may be impractical due to ongoing transmission and international regulations.

Keywords: *DVB-S2, 8-PSK, 16PSK, LDPC*

Mr V. Jeewa
B.Eng (UTM) M.Eng (UM)
FIEM MIET C.Eng P.Eng

1. Introduction

DVB-S2 incorporates an advanced Forward Error Correction (FEC) subsystem enabling almost error free operation of higher level Multi Phase Shift Keying (MPSK) constellation such as 8PSK, 16 Amplitude PSK (APSK) and 32 APSK. DVB-S2 is a vast improvement from the first generation DVB-S which used Reed Solomon concatenated with Convolutional codes and QPSK constellation.

The advanced design with its many configuration modes, presents a daunting task to engineers, who have to comprehend its signal flow process and thus specify the correct mode of operation in the field. Matlab software can be used in training courses to ease the learning process of new engineers. The main requirements of the trainer is that he should have working knowledge of both the DVB-S2 technical specifications [1] and Matlab programming.

The previous paper published in the ABU Technical Review No 242 April-June 2010 [2] could only focus on the DVB-S2 Simulink simulation model that was available at that time. Since then, Matlab has developed a programme parallel to the Simulink model that can conduct more advanced performance analysis under different configuration modes. This paper explains in simplified terms, the signal process flow of the Matlab software programme and relates it to the DVB-S2 parameters utilised for field operation. It focuses on the performance of two constellation modes namely QPSK and 8PSK at different code rates. Furthermore, an additional software programme based on 16 PSK has been designed and the performance analysed under different conditions.

2. Literature Review

The Forward Error Correction (FEC) subsystem, consists of Bose Chaudhuri Hocquenghem (BCH) code [3] concatenated with Low Density Parity Check Codes (LDPC) [4], which has error correction capability almost reaching the Shannon limit. The increase in BER performance enables the extension of lower constellation mode of QPSK to higher modulation order of 8PSK, 16APSK and 32APSK [5]. Hitherto, there has been no comparatively analysis of DVB-S2 performance between QPSK and 8PSK using Matlab simulation. The same statement can also be applied to 16 APSK and 32 APSK mode of operation. It must also be mentioned here, that there are slight differences in operation between 16APSK and 16PSK, but the latter has been chosen for this research project, as it simplifies the design of the Matlab programme. Thus, this project conducts research on QPSK and 8PSK performance and extends it to 16 PSK mode [6].

3. Problem Statement

Matlab programme based on simulating DVB-S2 can provide an inexpensive method of researching the performance of its various system configurations. The programme has been designed to record the response of DVB-S2 under different code rates and constellation modes. Existing research is at present mostly confined to QPSK and 16APSK [7] constellation. Thus, the Matlab programme has been modified to simulate system behaviour using 16 PSK also. From a review of past technical papers on DVB-S2, it can be deduced that there is a research gap in this particular area. In addition, the programme can be used as part of a hands-on toolkit to train new engineers in the classroom before being sent to the field.

4. Methodology

The research strategy undertaken is based on the simulation of DVB-S2 system under various configuration modes and recording the performance with various measurement tools. The Matlab programme, consisting of an end-to-end transmitter receiver chain, was modified to allow

for the extension of constellation modes to 16PSK. The technical parameters measured are Bit Error Rate (BER), Packet Error Ratio (PER) and Number of Iteration needed by the LDPC decoder. If PER $<10^{-7}$, the target of Quasi Error Free (QEF) performance is achieved. The number of iterations indicates the performance of the LDPC decoder under increasing noise level and DVB-S2 standard specifies maximum iterations to be 50.

5. DVB-S2 Matlab Programme

The Matlab programme, capable of simulating various configurations, is explained simply by Fig 1. At the transmitting end, a Random Data Generator acting as the signal source, delivers 188 bytes which can be regarded as an MPEG 2 Transport Stream. These packets act as the data field consisting of 1504 bits for the formation of Baseband Frame.

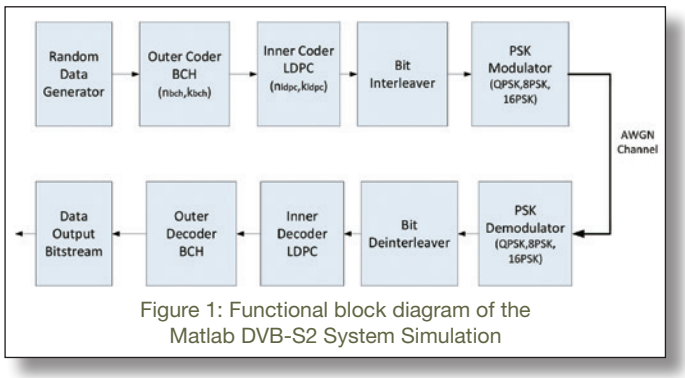


Figure 1: Functional block diagram of the Matlab DVB-S2 System Simulation

If a code rate =1/2 is chosen, a Baseband Frame of K_{BCH}=32208 bits is formed and processed by the Forward Error Correction (FEC) subsystem consisting of an Outer Coder which is a BCH (N_{bch}=32400, K_{bch}=32208) encoder concatenated with an Inner Coder comprising a LDPC (N_{ldpc}=64800, K_{ldpc}=32400) encoder. The frames are interleaved and modulated with a QPSK/8PSK/16PSK constellation and transmitted over an Additive White Gaussian Noise (AWGN) channel. The AWGN channel represents the uplink path from the earth station to the space satellite and the downlink path to the small parabolic antenna at the home.

6. Simulation Results & Discussion

As space is limited, only simulation results of certain configuration such as QPSK 9/10 and 1/2, 8 PSK 1/2 and 16 PSK 1/2 are shown in the following pages. Changes in the code rates are met by adjusting the N_{bch}, K_{bch} and K_{ldpc} parameters and are reflected in the output of the respective Outer and Inner Coders. These parameter changes provide easily understood explanation for the operation of the Baseband Frame stage and FEC subsystem. The selection of QPSK, 8PSK or 16 PSK affects overall performance and is easily visualised through the constellation display. Data shown are the BER at the demodulator output, the BER at the LDPC decoder output, and the PER of the end-to-end system together with the measured Signal to Noise Ratio (SNR) at the receiver input.

Data analysis from Table 1 & b indicates that QPSK performs better with a lower code rate ratio (CR) as BER reaches zero value faster if CR= 3/4 instead of CR=9/10. The results conform to theory as QPSK 3/4 is a stronger signal with more error correction capability although it can carry less payload. The BER plot of Fig 2a indicates that the LDPC has a waterfall region where the error curves drop steeply.

Table 1a: DVB-S2 Configuration Mode: *QPSK, Code Rate: 9/10, K_{bch}=58192, N_{bch}=58320, K_{ldpc}=58320, N_{ldpc}=64800*

Es/No dB	Demodulator Output BER	LDPC Decoder Output BER	Number of Iteration	Packet Error Ratio (PER)	Signal to Ratio (SNR) dB
0.0	1.58e-01	1.58e-01	50	1.00e+00	0.01
0.5	1.45e-01	1.45e-01	50	1.00e+00	0.51
1.0	1.31e-01	1.31e-01	50	1.00e+00	1.00
1.5	1.17e-01	1.17e-01	50	1.00e+00	1.50
2.0	1.04e-01	1.03e-01	50	1.00e+00	2.00
2.5	9.09e-02	9.09e-02	50	1.00e+00	2.51
3.0	7.89e-02	7.87e-02	50	1.00e+00	3.00
3.5	6.73e-02	6.72e-02	50	1.00e+00	3.49
4.0	5.63e-02	5.58e-02	50	1.00e+00	4.00
4.5	4.70e-02	4.55e-02	50	1.00e+00	4.49
5.0	3.75e-02	3.48e-02	50	1.00e+00	5.01
5.5	2.99e-02	2.45e-02	50	1.00e+00	5.50
6.0	2.30e-02	1.25e-02	50	1.00e+00	6.01
6.5	1.73e-02	0.00e+00	12	0.00e+00	6.50
7.0	1.26e-02	0.00e+00	6	0.00e+00	7.00

Table 1b: DVB-S2 Configuration Mode: QPSK, Code Rate: 1/2, K_{bch}=32208, N_{bch}=32400, K_{ldpc}=32400, N_{ldpc}=64800

Es/No dB	Demodulator Output BER	LDPC Decoder Output BER	Number of Iteration	Packet Error Ratio (PER)	Signal to Ratio (SNR) dB
0.0	1.59e-01	1.30e-01	50	1.00e+00	0.00
0.2	1.53e-01	1.18e-01	50	1.00e+00	0.20
0.4	1.48e-01	1.05e-01	50	1.00e+00	0.40
0.5	1.45e-01	9.55e-02	50	1.00e+00	0.49
0,6	1.42e-01	7.87e-02	50	1.00e+00	0.60
0.8	1.37e-01	2.61e-04	35	3.57e-02	0.80
1.0	1.31e-01	0.00e+00	31	0.00e+00	1.0
1.2	1.25e-01	0.00e+00	21	0.00e+00	1.19
1.5	1.17e-01	0.00e+00	18	0.00e+00	1.50

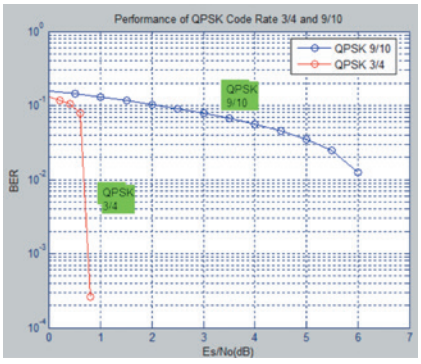


Fig 2a:
DVB-S2 QPSK BER Performance F

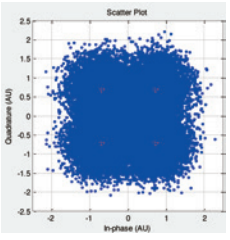


Fig 2b:
QPSK Scatterplot

The LDPC Inner Decoder does most of the error correction, leaving the BCH Outer Decoder to operate in the error floor region where the LDPC code cannot reach. Fig 2b shows the QPSK signal with its 4 constellation points which can still operate in such a noisy environment.

From Table 2a & b, 8 PSK does not perform as well as QPSK as it requires higher Es/No for better BER

Table 2a: DVB-S2 Configuration Mode: 8PSK, Code Rate: 9/10, K_{bch}=58192, N_{bch}=58320, K_{ldpc}=58320, N_{ldpc}=64800

Es/No dB	Demodulator Output BER	LDPC Decoder Output BER	Number of Iteration	Packet Error Ratio (PER)	Signal to Ratio (SNR) dB
0.0	2.41e-01	2.46e-01	50	1.00e+00	0.00
0.5	2.28e-01	2.34e-01	50	1.00e+00	0.50
1.0	2.16e-01	2.21e-01	50	1.00e+00	1.00
1.5	2.03e-01	2.08e-01	50	1.00e+00	1.50
2.0	1.90e-01	1.95e-01	50	1.00e+00	2.00
2.5	1.77e-01	1.82e-01	50	1.00e+00	2.51
3.0	1.65e-01	1.69e-01	50	1.00e+00	3.01
3.5	1.52e-01	1.56e-01	50	1.00e+00	3.50
4.0	1.41e-01	1.44e-01	50	1.00e+00	4.00
4.5	1.28e-01	1.32e-01	50	1.00e+00	4.51
5.0	1.17e-01	1.20e-01	50	1.00e+00	5.00
5.5	1.06e-01	1.09e-01	50	1.00e+00	5.51
6.0	9.56e-02	9.83e-02	50	1.00e+00	6.01
6.5	8.58e-02	8.81e-02	50	1.00e+00	6.50
7.0	7.62e-02	7.83e-02	50	1.00e+00	7.00
7.5	6.72e-02	6.87e-02	50	1.00e+00	7.49
8.0	5.86e-02	5.98e-02	50	1.00e+00	7.99
8.5	5.00e-02	5.04e-02	50	1.00e+00	8.51
9.0	4.25e-02	4.19e-02	50	1.00e+00	9.00
9.5	3.54e-02	3.30e-02	50	1.00e+00	9.51
10.0	2.90e-02	2.38e-02	50	1.00e+00	10.00
10.5	2.33e-02	1.27e-02	50	1.00e+00	10.50
11.0	1.83e-02	0.00e+00	14	0.00e+00	11.00
11.5	1.41e-02	0.00e+00	7	0.00e+00	11.49

Table 2b: DVB-S2 Configuration Mode: 8PSK, Code Rate: 3/4, K_{bch}=48408, N_{bch}=48600, K_{ldpc}=48600, N_{ldpc}=64800

Es/No dB	Demodulator Output BER	LDPC Decoder Output BER	Number of Iteration	Packet Error Ratio (PER)	Signal to Ratio (SNR) dB
0.0	2.41e-01	2.57e-01	50	1.00e+00	0.00
0.5	2.29e-01	2.44e-01	50	1.00e+00	0.50
1.0	2.16e-01	2.30e-01	50	1.00e+00	1.01
1.5	2.03e-01	2.17e-01	50	1.00e+00	1.51
2.0	1.91e-01	2.04e-01	50	1.00e+00	2.00
2.5	1.77e-01	1.90e-01	50	1.00e+00	2.51
3.0	1.66e-01	1.78e-01	50	1.00e+00	3.00
3.5	1.53e-01	1.64e-01	50	1.00e+00	3.51
4.0	1.41e-01	1.52e-01	50	1.00e+00	4.01
4.5	1.29e-01	1.39e-01	50	1.00e+00	4.50
5.0	1.17e-01	1.26e-01	50	1.00e+00	5.00
5.5	1.06e-01	1.13e-01	50	1.00e+00	5.51
6.0	9.59e-02	1.00e-01	50	1.00e+00	6.01
6.5	8.62e-02	8.62e-02	50	1.00e+00	6.49
7.0	7.60e-02	7.13e-02	50	1.00e+00	7.01
7.5	6.69e-02	4.32e-02	50	1.00e+00	7.50
8.0	5.83e-02	0.00e+00	20	0.00e+00	8.00
8.5	5.02e-02	0.00e+00	12	0.00e+00	8.49

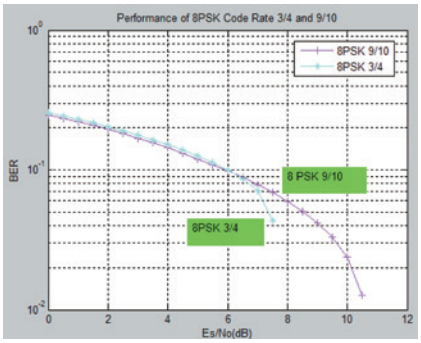


Fig 3a: DVB-S2 8PSK BER Performance

Fig 3b: 8PSK Scatterplot

performance. In spite of this, 8 PSK can be used as the LDPC decoder is capable of correcting errors, even at low signal power. Fig 3a indicates that both 8 PSK 3/4 and 9/10 give almost similar performance at low Es/No but at higher signal energy, 8PSK 3/4 gives better improvement. Fig 3b shows the 8PSK constellation points indicating that the signal is delivering the data transmitted to the receiver without significant errors.

As expected, data from Table 3 confirms that higher signal strength is needed for 16 PSK mode to achieve a BER

Table 3: DVB-S2 Configuration Mode: 16PSK, Code Rate: 3/4, K_{bch}=48408, N_{bch}=48600, K_{ldpc}=48600, N_{ldpc} = 64800

Es/No dB	Demodulator Output BER	LDPC Decoder Output BER	Number of Iteration	Packet Error Ratio (PER)	Signal to Ratio (SNR) dB
0.0	3.41e-01	3.41e-01	50	1.00e+00	0.00
0.5	3.30e-01	3.30e-01	50	1.00e+00	0.49
1.0	3.19e-01	3.19e-01	50	1.00e+00	1.00
1.5	3.08e-01	3.08e-01	50	1.00e+00	1.51
2.0	2.96e-01	2.96e-01	50	1.00e+00	1.99
2.5	2.85e-01	2.85e-01	50	1.00e+00	2.49
3.0	2.72e-01	2.72e-01	50	1.00e+00	3.00
3.5	2.60e-01	2.60e-01	50	1.00e+00	3.51
4.0	2.48e-01	2.48e-01	50	1.00e+00	3.99
4.5	2.34e-01	2.34e-01	50	1.00e+00	4.51
5.0	2.21e-01	2.21e-01	50	1.00e+00	5.00
5.5	2.09e-01	2.09e-01	50	1.00e+00	5.51
6.0	1.97e-01	1.97e-01	50	1.00e+00	5.99
6.5	1.84e-01	1.84e-01	50	1.00e+00	6.51
7.0	1.73e-01	1.73e-01	50	1.00e+00	7.00
7.5	1.62e-01	1.62e-01	50	1.00e+00	7.50
8.0	1.51e-01	1.50e-01	50	1.00e+00	8.01
8.5	1.40e-01	1.40e-01	50	1.00e+00	8.50
9.0	1.30e-01	1.30e-01	50	1.00e+00	9.00
9.5	1.21e-01	1.19e-01	50	1.00e+00	9.50
10.0	1.11e-01	1.08e-01	50	1.00e+00	10.01
10.5	1.02e-01	9.78e-02	50	1.00e+00	10.50
11.0	9.33e-02	8.66e-02	50	1.00e+00	11.00
11.5	8.50e-02	7.57e-02	50	1.00e+00	11.49
12.0	7.74e-02	6.21e-02	50	1.00e+00	11.99
12.5	6.91e-02	4.13e-02	50	1.00e+00	12.50
13.0	6.15e-02	0.00e+00	24	0.00e+00	12.99

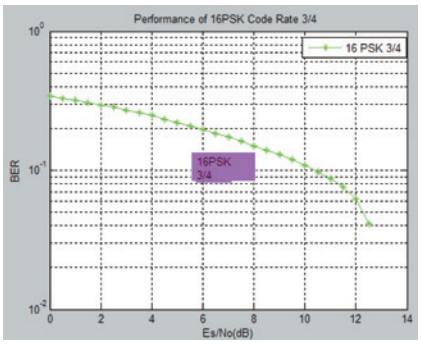


Fig 4a:
DVB-S2 16 PSK BER Performance

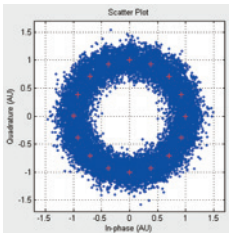


Fig 4b:
16PSK Scatterplot

of zero value. 16 PSK requires Es/No = 13 db to achieve error free operation when compared to 8 PSK which only needs 8 db. Fig 4a shows the steady decline in BER as signal strength gathers whilst Fig 4b indicates that 16 PSK operation can be sustained at reasonable field strength. Only 16 PSK with code rate 3/4 is shown so as to reduce publication space.

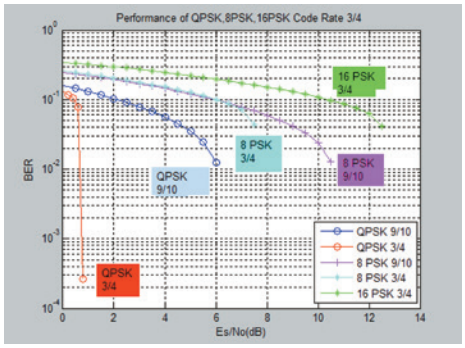


Fig 5: Comparison of QPSK, 8PSK and 16 PSK Bit Error Rate Performance

Comparative analysis of all the configuration modes are laid out in Fig 5 for the sake of convenience. Simply put, the progress from a lower constellation mode to a higher constellation mode requires higher signal power. This is caused by the shrinking in distance of the constellation points from each other, which would result in the points not being detected accurately, especially when noise is becoming troublesome. The change in code rate also substantially influences the BER as a received MPSK signal with CR= 3/4 has more robust error correction capability compared to a signal with CR= 9/10.

7. Conclusion

The Matlab programme can be used during training sessions in the field of Digital Broadcasting. It is essential that engineers comprehend the advanced FEC subsystem and the theory behind Shannon's Theorem, relating the maximum capacity that can be achieved over a given channel with certain noise characteristics and bandwidth.

Overall the performance of DVB-S2 is remarkable, as low BER is achieved even at low signal strength making the use of 16 PSK a feasible choice. UHDTV services require much higher bitrates compared to HDTV and cannot be met by using the present 8PSK mode. Therefore, communication engineers have to incorporate higher constellation modes in their designs.

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author

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B.Eng, M.Eng., FIEM, MIET, C.Eng, P.Eng

V.Jeewa was appointed as a Broadcast Engineer to Radio TV Malaysia in 1979. He has served the Malaysian government for more than 35 years and the last position he held before retiring was Deputy Director, Tun Abdul Razak Broadcast & Information Institute, Ministry of Communication & Multimedia.

Ir V. Jeewa hold a Masters in Telecommunication Engineering from the University of Malaya and a Bachelor of Engineering (Electrical) from University Technology Malaysia. His past academic experience include being a part time lecturer at University of Technology MARA. He has presented papers and delivered lectures in his specialised field. The Institution of Engineers has also twice awarded him the Tan Sri Ir Hj Yusoff Ali Prize, in 2006 and 2009, for best technical paper in the Electrical field. He has also won the Asia Pacific Broadcasting Union {ABU} Second Best Article in 2010.

He is presently attached to the Lee Kong Chian Faculty of Engineering and Science, University Tunku Abdul Rahman, Malaysia as part of the academic staff holding the post of Specialist II/Senior Lecturer. He is also conducting research into Digital Broadcasting and pursuing the Ph.D in the same field.

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InterBEE 2017

By **Mr Anthony Roebeck**
Samoa Broadcasting Corporation

The 53rd International Broadcast Equipment Exhibition, a professional exhibition of audio, video and communications equipment, was held at Makuhari Messe in Chiba, Japan from 15 to 17 November 2017. The event was organised by The Japan Electronics and Information Technology Industries Association (JEITA) with the support of various partners.

A record high of 1,139 exhibiting companies and organizations participated in the Inter BEE 2017, which is a 4.5 percent participation increase compared to the previous year.

Inter BEE brought together under one roof state-of-the-art video and audio production, compression/transmission and display technologies, including 4K/8K shooting/editing technologies as well as high dynamic range (HDR) and high frame rate (HFR). In particular, there was an increase in the number of exhibitors offering 8K technologies.

IT-related companies also attended Inter BEE to utilize clouds toward increasing the efficiency of broadcasting operations or Internet distribution and to capture the Internet protocol (IP) market. These companies showcased content distribution networks (CDN) for the first time. Moreover, new trends not previously seen at Inter BEE were unfolded such as the holding of a fifth generation mobile communication system (5G) session in the keynote speech in addition to running the IP Showcase that compile themes in IP live transmission.

An experience demo of speakers used for live events and other applications was one of the main attraction of Inter BEE. This brought together a record high of 15 products in the largest arena of the Makuhari Messe Event Hall to allow visitors to experience the quality of loud sound. This provided the invaluable opportunity to see a line-up of high quality products for which there are few chances to listen and compare.

It was an opportunity to experience the media communications and entertainment world of the near future at Inter BEE through exhibitions and presentations of the latest products by companies exhibiting from Japan and overseas, as well as conference sessions and events with various themes. A showcase for the world's most advanced technologies, Inter BEE continues to respond to the needs of professionals in the field. By incorporating both Japanese and international markets, the exhibition has become a steady channel of industry information to its target audience. For exhibitors and visitors alike, Inter BEE continues to be a forum for effective exchange of meaningful information and the creation of business opportunities.

Attending Inter BEE 2017 was one of the highlights of my career. It provided the opportunity to be part of a state of the art exhibition, provided access to the most advanced technology in the broadcast industry, allowed an invaluable network with top professionals in the field, and renewed and boosted motivation to better our service. The experience further brought emphasis on the fast paced advancing technology that is readily available to the developed world. Although this technology may be a challenge for us, a small Pacific Island broadcaster, to attain given our limited resources, we try our very best to keep up and not be left behind.

My heartfelt gratitude to ABU and JEITA for this wonderful opportunity and hope more capacity building opportunities come our way.

ABU Technical Advisory Service
to Myanmar Radio and Television (MRTV)

4th – 8th December 2017

By **Mr Milos PAVLOVIC,** MSc, Dipl.-Ing
Sales Director Broadcast LS telcom AG, Germany

As an ABU (Asia-Pacific Broadcasting Union) Technical Advisory Service mission to one of ABU's members, MRTV (Myanmar Radio and Television), LS telcom AG provided a week long technical course on modern broadcasting coverage and frequency planning. The course, delivered by Milos Pavlovic, Sales Director Broadcast, included a vast selection of topics that the LS Training Academy offers on a regular basis. LS telcom AG, also a member of ABU, is the global leader in spectrum efficiency and its Training Academy has trained thousands of delegates who have received professional training since the foundation of the LS Training Academy in 2003.

The course was aimed at engineers working in the broadcast industry in Myanmar, and who focus on the planning and regulation of audio and television terrestrial broadcasting networks.

The training took place in the MRTV Headquarters in Tatkone Township in Myanmar, and in addition to MRTV, the course participants came from the Ministry of Transport and Communications, MWD (Myawaddy, the Ministry of Defense), MRTV-4 (Forever Group Co., Ltd -Private) and Sky Net DTH (Shwe Than Lwin Media Co., Ltd -Private).

Figure 1: Training Participants

The training included a wide range of theoretical and practical topics, from the introduction to broadcast theory, to wave propagation effects and propagation models, through to detailed presentation of required data (mapping and transmission), interference theory, broadcast network analysis and finally the network optimisation process based on different criteria.

The DVB-T2 standard, one of the two standards for terrestrial TV broadcasting in Myanmar (besides DVB-T operated by Myawaddy), was the main focus of the course. Participants were made familiar with the specific features and particularities of DVB-T2 compared to DVB-T and other terrestrial standards. The trainer of the course also explained in detail how extended single frequency networks (SFN) bring extensive capacity gains, and at the same time prospects for terrestrial HDTV.

The course participants learnt about the theory of DVB-T2 parameters, including the calculation of Mux capacity and the according minimum required field strength. The theoretical part was complemented with planning examples of MRTV DVB-T2 networks, practicing feasibility for large area SFNs using LS telcom's broadcast planning tools. The current worldwide DVB-T2 status, the DVB-T2 lite profile and DVB-T2 compatibility with LTE completed the DVB-T2 related sections of the course.
Besides DVB terrestrial standards, the course introduced other terrestrial TV and radio standards such as ISDB-T, ATSC(3.0), DAB(+), DRM (+), etc. The course covered different coordination procedures and compatibility checks, providing a balance of theory as well as practical demonstration. The trainer also addressed broadcast measurement procedures, including advanced drone based antenna verification measurements.

The training was rounded off with topics on analogue to digital switchover, strategic broadcast consulting, planning and allocation of the digital dividend, coexistence of DTT and other services, and finally alternative broadcast content distribution platforms and general future broadcast scenarios.

After completing the course, participants gained a thorough understanding of all the necessary functionality needed in the planning procedures, both in theory and practice. Many local, Myanmar specific examples were used to give detailed information about handling particularities that may occur in the planning and implementation phases.

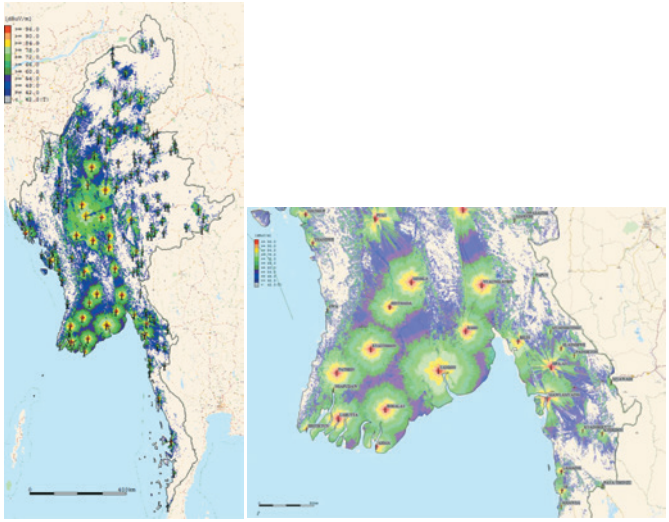


Figure 2: DVB-T2 nationwide coverage in Myanmar

RADIO NEPAL EQUIPPED WITH A MODERN OUTDOOR BROADCAST VAN

By **Mr Shree Bhadra Wagle**
Deputy Executive Director, Radio Nepal

Radio Nepal has upgraded its broadcasting system with a modern Outdoor Broadcast (OB) Van. The central studio at Singhadurbar in Kathmandu is equipped with it as a part of upgrading its Radio contribution link. Different events, conferences, fairs etc. can be broadcast live from within and outside the capital city with the help of the facility. The 12-seater 4WD Van carries VHF and UHF Transmitters with a 2-stack broadband antenna for STL link. The antenna mast can be erected up to a height of approx 50 ft and rotated in azimuth and elevation range with the air suspension motorized drive. A 12-channel robust digital studio mixer with Audio File System, IP Codec and Telephone hybrid can also be linked with the central studio using conventional and cellular telephone network. The system has rack mounted CD, digital players/recorders with a number of microphones and an audiovisual monitoring assembly. The OB vehicle also includes a Public Address (PA) System for engaging audiences when hosting local events, fares and cultural ceremonies. Backup power in the form of a rack mounted UPS and a Portable Generator is available in case of city supply failure.

Earlier in 15 June 2016, Record of Discussions (R/D) was signed as a part of Republic of Korea government ODA project for the improvement of Radio Broadcasting Environment in Nepal. The R/D was signed by Vice Chairman/CEO of The Korean Radio Promotion Association (RAPA) and Executive Director of Radio Broadcasting Service (Radio Nepal). The outside broadcast system was donated to Radio Nepal by RAPA with the technical coordination of the ABU.

New Members

Additional Full Members

JSC – Kazakhstan Joined ABU

Republic TV and Radio Corporation – JSC is a national broadcaster of the Republic of Kazakhstan. It operates two national and 14 regional TV channels as well as four radio stations and 36 websites.

The broadcast coverage it maintains covers 100% of the territory of the Republic of Kazakhstan as well as border areas of the Russian Federation, Kyrgyzstan, Uzbekistan, Turkmenistan, China and Mongolia.

Associate Member

Reach Beyond Australia

Reach Beyond Australia (RBA) operates as a World Office within the global structure of Reach Beyond, committed to reaching previously unreachable groups with the gospel. It operates an International Broadcast Facility consisting of the studio and administration centre at Kilsyth, Melbourne and transmission site at Kununurra, Western Australia.

RBA is an evangelical, non-denominational, multicultural, faith mission primarily involved in radio broadcasting both in its own right and with ministry partners. It has been granted four international broadcast licences by the Australian Broadcasting Authority. These permit transmissions to the geographical regions of South Asia, South East Asia, East Asia and South Pacific.

Albanian Radio and Television

Albanian Radio and Television (Radio Televizioni Shqiptar – RTSH) is the public broadcaster of Albania, founded in 1938 in Tirana.

RTSH runs two analogue and digital television stations RTSH 1 HD and RTSH 2 HD, five digital thematic television stations known as RTSH, and three radio stations using the name Radio Tirana. In addition, four regional radio and TV stations serve in Gjirokastër, Korçë, Kukës, and Shkodër.

The international radio service broadcasts radio programmes in Albanian and seven other languages via medium wave (AM) and short wave (SW). The international television service via satellite RTSH 3 HD (former TVSH Sat) was launched in 1993 and is aimed at Albanian-speaking communities in Kosovo, Serbia, Macedonia, Montenegro, and northern Greece, plus the Albanian diaspora in the rest of Europe. Since 1999, RTSH has been a member of the European Broadcasting Union.

UA|TV of Ukraine joined the ABU

UA|TV Channel as a part of The International Broadcasting Multimedia Platform of Ukraine, is addressed to worldwide foreign audiences, who are interested in obtaining objective, comprehensive and up-to-date information originating in Ukraine and about Ukraine. UA|TV started broadcasting on October 1, 2015. At the moment, the channel is re-transmitted from 3 satellites: Hot Bird 13 (Europe), Galaxy 19 (North America), and Azerspace 1 (Asia). It is also launched in cable networks in Europe, North America and the Middle East.

Viewers can watch daily newscasts in English, Russian, Arabic, Crimean-Tatar and Ukrainian languages, along with programs on current developments in Ukraine – in the East and Crimea, on the progress of economic reforms, on achievements in sciences and culture, about famous Ukrainians and courageous contemporaries, about history, about wonderful nature and touristic routes.

News
from the ABU Region

TVK – Cambodia Selects LiveU to Enhance Daily News

TVK, The National Television of Kampuchea in Cambodia, has selected LiveU for its daily newsgathering after using the company's LU600 HEVC solution to cover the three-day Water Festival (Bon Om Touk). Using LiveU units, TVK's camera crew creatively captured the carnival atmosphere of the festival, one of the biggest events in Cambodia which attracts millions of people every year. Firework displays were held at the river and more than 400 boats took part in the annual boat race.

"We were really impressed by the LU600 HEVC's video performance as well as the bandwidth efficiency. We were getting bandwidth at around 10Mbps, and even when we capped the bandwidth at 5Mbps, the video quality stayed the same" said Mr Khim Vuthy, Director General of National Television of Cambodia (TVK). "At previous water festivals, we used satellite OB vans which restricted our mobility. With LiveU's cellular bonding technology, we had no such limitations and were free to go live wherever we wanted, including on boats to cover the races and from the top of a building when the King arrived. We're now planning to use multiple LiveU units for our daily newsgathering and event coverage." Mr Yaal Eshel, VP Sales at LiveU, said, "We were excited to support TVK's coverage of the water festival which provided an excellent use case for our HEVC solution. The new LU600 H.265 has been proven by our customers to enable live video transmission in extreme conditions from ultra HD quality to very low bandwidth."

(LiveU-news)

RTM-Malaysia Upgrades for Digital Studios

Malaysia's public radio and TV broadcaster, RTM, is digitising its regional studios across the country. Stagetec Asia, partnering with Berlin-based manufacturer Stage Tec, has just completed a major contract in the country. Four AURATUS platinum desks and four NEXUS audio networks were installed at four regional radio stations in the state of Sarawak. Each of the four AURATUS consoles has 24 faders and each of the NEXUS audio network includes four Base Devices. Stage Tec digital mixing desks and digital audio networks are vital building blocks of the strategy. The RTM studios Miri, Limbang, Sri Aman and Sibu went digital as part of the transition to the DAB standard.

Multi-purpose studios in the radio stations have been fitted with the AURATUS consoles and NEXUS audio routing systems. Various live music events are mixed here, which require flexibility and high-quality audio. The consoles are integrated via fibre-optic cables into a NEXUS network, which can handle a variety of inputs and outputs.

(C+T)

Singapore: One More Year Before the End of Analogue TV Broadcast

Households will have one more year to switch to Digital TV after the Infocomm Media Development Authority (IMDA) announce that the deadline to pull the plug on analogue TV broadcast has been shifted from end-2017 to December 31, 2018.

In a media release, IMDA said Mediacorp will continue to broadcast in both analogue and digital formats until December 31, 2018. About three in four households currently already receive Digital TV either over the air or through their pay-TV subscription, according to IMDA. Additionally, the authority said it is studying enhancements to the Digital TV Assistance Scheme (DTVAS), to potentially help more Singaporean households living in Housing and Development Board (HDB) flats with the switchover. IMDA will provide details about the enhancements soon, it said.

These announcements were made by Minister for Communications and Information Dr Yaacob Ibrahim in a written parliamentary response last year. Since the launch of the DTVAS in September 2014, IMDA has sent out notification letters to more than 139,000 eligible households. As of October 17, about 64,000 DTVAS packages have been given out, and many households have not responded to their notification letters, IMDA said. All analogue TV channels will include an "Analogue" channel logo on the top right of the TV screen, IMDA said. This is to help viewers determine whether they will be affected when the analogue TV broadcast comes to an end. Households who see this logo will need to switch over to Digital TV to continue watching Mediacorp TV channels from January 1, 2019.

(CNA)

SBS News – Australia Unveils New Look and App

SBS has refreshed its news portfolio, launching SBS News with increased capabilities across its broadcast and digital platforms and a bold, new look bring its range of news platforms together under the SBS News banner. A new SBS News app has also been released to give audiences greater access to the latest news from Australia and around the world.

The new SBS News brand will span SBS World News, Insight, Dateline, The Feed, Small Business Secrets and SBS's news website. The brand refresh reflects SBS's continued commitment to quality, in-depth news and current affairs from Australia and around the world. Improvements to the network's digital platforms aim to make SBS's news and current affairs content more accessible to audiences, with the latest news available anytime and anywhere.

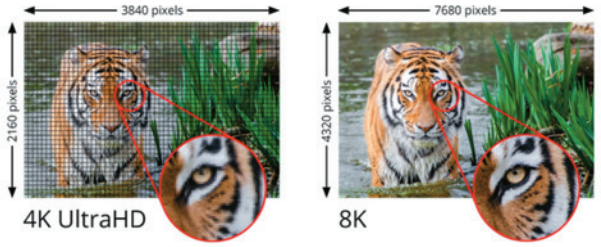
SBS Director of News and Current Affairs, Jim Carroll said, "We've given SBS News a new look and new capabilities to reflect SBS's digital-first strategy that puts audiences at the heart of everything we do.

(sbs.com.au)

Digital Broadcasting Update

HDMI Forum Releases Version 2.1 of the HDMI Specification

A Huge Leap Forward Supports Resolutions Up to 10K and Dynamic HDR and Introduces New Ultra High Speed HDMI Cable



HDMI Forum, Inc. has announced the release of Version 2.1 of the HDMI® Specification which is now available to all HDMI 2.0 adopters. This latest HDMI Specification supports a range of higher video resolutions and refresh rates including 8K60 and 4K120, and resolutions up to 10K. Dynamic HDR formats are also supported, and bandwidth capability is increased up to 48Gbps.

Supporting the 48Gbps bandwidth is the new Ultra High Speed HDMI Cable. The cable ensures high-bandwidth dependent features are delivered including uncompressed 8K video with HDR. It features exceptionally low EMI (electro-magnetic interference), which reduces interference with nearby wireless devices. The cable is backwards compatible and can be used with the existing installed base of HDMI devices.

(HDMI)

DVB Completes Current Generation of Specifications for UHDTV Services

Important Revisions and Updates for DVB UHD Services over IP-Based Networks and Bitmapped Subtitling for UHDTV

At the 87th meeting of the DVB Steering Board (SB) important revisions and updates for three DVB specifications were approved. This development marks the completion of the current generation of specifications for Ultra High Definition Television – DVB UHD-1.

DVB UHD-1 covers elements for the improvement of video and audio quality for broadcast TV services. In addition to UHD (4k) resolution and a wider colour space, these elements include High Dynamic Range (HDR) for increased contrast ratios, Higher Frame Rates (HFR) for sharper images of moving objects, and Next Generation Audio (NGA) for the support of object- or scene-based audio schemes. The revisions and updates pertain to DVB-DASH, audiovisual coding and bitmapped subtitles.

The revision of ETSI TS 103 285, the DVB MPEG-DASH Profile for Transport of DVB Services over IP Based Networks, was approved. It adds the following new features: the provision of live text messages and slideshows for use with Hybrid Digital Radio; support for linking interactive applications to broadcast services delivered by DVB-DASH; HDR; HFR; NGA.

Also approved were amendments to TS 101 154, the DVB video and audio coding specification. The amended specification contains H.264/AVC and HEVC video conformance points for use with MPEG DASH. These are aligned with the broadcast codec conformance points, supporting a similar feature set, but take into account the specific requirements of adaptive bitrate delivery over IP-based networks.

Lastly, amendments to DVB Subtitling Systems (ETSI EN 300 743) were approved. These add explicit support of subtitling for UHDTV services, as defined in ETSI TS 101 154 and ETSI EN 300 468. The latest revision introduces technical extensions specifically for progressive-scan subtitle object coding and the capability to provide the subtitle CLUT (Color Look-Up Table) for colour systems other than ITU-R BT.601. The new progressive-scan subtitle object coding allows subtitles to be converted from suitably coded PNG files. The bitmap-based subtitle specification is complemented by TTML-based subtitle specification, draft EN 303 560, which was approved by the SB in July 2017.

(DVB)

HbbTV Association Announces Publication of IPTV Specification

The HbbTV Association has announced that it has finalised and published its IPTV Specification. This specification builds on HbbTV 2.

The new specification has been published by ETSI as TS 103 555 and it defines how HbbTV terminals (e.g. set-top boxes and televisions) can be used with IPTV services. Two distinct types of terminals are covered by the specification. One is a pure IPTV terminal with only an IP connection and no classical antenna (RF) input, where all TV content is received via IP. The other type is a hybrid IPTV terminal that has both an IP connection and a classical RF-based broadcast connection. Such terminals can switch between presenting content received via IP and content received via RF-based broadcast without rebooting or even interrupting a running HbbTV application.

(HbbTV)

Equipment Trends

HEVC Encoder for Live UHD Video Delivery

HE4000 Allows Broadcasters to Cost-Effectively Address the Growing Consumer Demand for High-Quality Live Content

AVIWEST has announced the HE4000 HEVC encoder, the broadcast industry's first encoder to enable live UHD (4K) video delivery over unmanaged networks in a compact ?-RU design that reduces space requirements, enabling broadcasters to cost-effectively address consumer demand for superior-quality live content, delivered via 4G/LTE, satellite (Ka- and Ku-band, BGAN), wired IP network, or a combination of IP links. By combining HEVC encoding and AVIWEST's SafeStreams® technology, the HE4000 dramatically reduces bandwidth costs while guaranteeing superior video quality.

Combining 10-bit and 4:2:2 HEVC encoding with the latest generation of AVIWEST's SafeStreams contribution technology ensures reliable delivery of live SD, HD, and UHD video over IP at low latencies and bit rates. The platform is compatible with the latest HDR formats and allows broadcasters to encode up to four simultaneous HD video streams or a single 4K UHD channel from a single encoder.

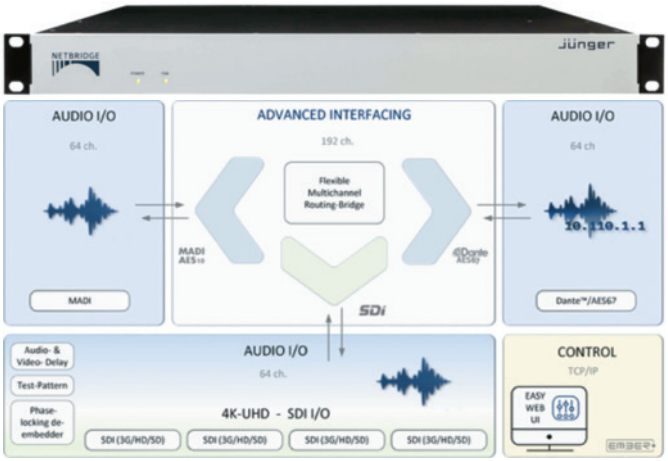
AVIWEST's SafeStreams technology implements an intelligent IP bonding stack and powerful contribution network protocols, such as the HARQ (Hybrid Automatic Repeat Request) mechanism to ensure the HE4000 can deliver live video even in the midst of unpredictable and unmanaged network conditions. This enables broadcasters to provide news and sports coverage from any location around the world.

The HE4000 contribution encoder offers integration with the AVIWEST DMNG Manager and DMNG StreamHub receiver, decoder, and distribution platform, enabling stations to receive content and monitor, manage, and control all transmissions with a single interface.

(AVIWEST)

Compact Multichannel Bridge

This advanced interface allows for simple and fast integration of 4K-UHD into MADI and AoIP infrastructures



As the broadcast industry continues its transition to 4K, German manufacturer Jünger Audio has introduced Netbridge UHD - a new, advanced interface that closes the gap between digital audio production systems and modern video formats. This elegant 19-inch product allows for simple and fast integration of 4K-UHD or four HD video streams into MADI and AoIP (AES67 and DANTE™) infrastructures. With its four 3G SDI interfaces, Netbridge UHD is also ideal as an audio video front end for small and medium-sized video editing suites or workstations.

Netbridge UHD is configured and operated via a standard web browser, with all system parameters also controlled by the Ember+™ protocol, thus ensuring simple integration with any broadcast automation or scheduling system.

Jünger Audio's Netbridge series also includes Netbridge MADI, which provides an AES67 alternative to the 1:1 translation between MADI and DanteTM. The system is equipped with two independent 64-channel bridges and can thus translate up to 128 channels between IP and classic MADI systems.

(Jünger Audio)

Personalities & Posts

Appointment of New ABU Technical Liaison Officer and Technical Bureau Member

Mr Yoichi Kondo

Mr Yoichi Kondo

Director Department of JNN Technology, TBS Television Inc, TBS-Japan

Mr Yoichi Kondo, Director Department of JNN Technology has taken over from Mr Keisuke Miki as the ABU Technical Liaison Officer and ABU Technical Bureau Member for TBS-Japan.

Mr Yoichi Kondo joined TBS in 1986, working in the TV Technology Division. In 2005 he was assigned to the Division of Information and Communication Technology. Mr Kondo was assigned to the Division of TV Technology in 2017. He holds a degree from the Department of Electrical and Electronic Engineering at the University of Tokyo.

We welcome Mr Kondo as the new TLO for TBS.

We take this opportunity to thank Mr Keisuke Miki for his contributions to the ABU Technical Bureau.

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THE BEST WAY TO PREDICT THE FUTURE IS TO CREATE IT. PETER F. DRUCKER

Why are we watching the global Television shipment data ?

Because the size, format and brightness of the television sets being sold have a direct influence on viewer behaviour. That, in turn directly affects the system design of current or future television channels (and transmission head ends). Larger screens, UHD TV, smart TV in more homes will change viewing habits irrevocably. Broadcasters need to make sure that they are leading the change.

We specialise in building broadcast facilities that are digital, IP centric, automated, 4K ready, transmitting over multiple formats and capable of handling dynamic business models.

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