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FULL REPORT INSIDE

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ALSO INSIDE

QoE Enhancement for Streamed Video
by Reducing Quality Changes during Playout

Inside

Cover: ABU DIGITAL BROADCASTING SYMPOSIUM 2022

Asia-Pacific Broadcasting Union

from the Editor

Welcome to the first edition on the Technical Review for this new year 2022. This first quarter has given us a lot of hope for better days to come, leaving the pandemic behind. We hope and pray that things will continue to improve. As usual this first quarter edition is more focused on the recently concluded ABU DBS 2022 Virtual Event which was held from 21-24 March.

The 18th edition of ABU's Digital Broadcasting Symposium (DBS) was organised as a virtual event for a second year due to the ongoing pandemic. We are extremely grateful for the support from our members and our industry partners in organising the event. The 4-day event consisted of 12 conference sessions and 5 workshops which were presented by over 65 experts from around the world. These sessions addressed more than 50 topics and discussions. Some of the key topics of discussion included; Evolving Business Strategies in Broadcast, Cybersecurity and Media, AI and Bigdata applications in Media, Broadcasting on the Cloud, 5G Applications in Media, IP Technologies, and Remote Production.

This edition also carries three feature articles. The first one contributed by colleagues from IRIB-Iran with the title "QoE Enhancement for Streamed Video by Reducing Quality Changes during Playout", which discusses a new algorithm for use with adaptive streaming technology to achieve better quality for a given network condition. The second on "Linear Television Broadcasting over 5G Networks", contributed by experts Dr Les Sebel and Mr Peter Walop, looks at the very interesting area of linear broadcast over 5G sharing their viewpoint based on the multiple test results from within the industry. The third and final article for this edition is contributed by WorldDAB as the third part of their continuing series on DAB digital radio implementation titled "The DAB adoption process, Part 3: DAB+ requirements and allotment Planning".

This edition also includes highlights from some activities organised by ABU Technology during the last few months. The edition concludes with our regular highlights from the industry news, digital updates and the latest in equipment trends. We hope you will benefit from the information and materials included.

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QoE Enhancement for Streamed Video by Reducing Quality Changes during Playout

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Adaptive streaming, allows dynamic bit rate matching in different network conditions to reach an acceptable quality of experience level. In this paper, a rate adaptation algorithm is proposed for HAS (HTTP adaptive streaming) that determines the video bit rate based on the playback buffer level and the estimated bandwidth. The main property of this algorithm is reducing fast large changes of the media quality level and preserving the pre-defined minimal buffer length to reduce the media stall time. The proposed scheme was compared with other algorithms in single-client scenarios. The simulation results, in different network conditions, demonstrate high quality levels with smooth variations compared with existing solutions.

KEYWORDS
Quality of Experience, Video Streaming, Rate Adaptation. Playback, HAS

INTRODUCTION

Based on the statistics and predictions presented in *Forecast and Trends 2017-2022 White paper by Cisco public*, 82 percent of total internet traffic capacity will be video traffic by 2022. HTTP streaming has also become a cheap solution for multimedia content transmission based on being supported by internet infrastructure and permitted by most firewalls.

Traditional streaming solutions, utilise protocols such as real-time transport protocol (RTP) and real-time streaming protocol (RTSP) based on user datagram protocol (UDP) to control the video transmission rate. However, such protocols are difficult to deploy, because a specialised streaming server is required. In order to survive this constraint, the MPEG DASH protocol has been proposed.

Dynamic adaptive streaming over HTTP (DASH) [see "ISO/IEC IS 23009-1"] is an HTTP-based technique standardised by moving picture experts group (MPEG). For each item of multimedia content, a document is considered by MPEG-DASH called media presentation description (MPD), containing information about existing representations of multimedia content stored in the server. Each representation is divided into several segments, accessible by their Universal Resource Locator (URL). A client requests each segment from the server using a HTTP GET message. Also, for each representation, a profile is dedicated for specifying supported resolutions and encoding parameters.

In this paper, a client-side playout rate adaptation algorithm is proposed. As specified in the following sections, the basic idea is to select the video bit rates based on the playback buffer level and estimate bandwidth for each decision period.

Selecting high-quality video levels for playback, while reducing large changes in quality level of different segments and avoiding playback interruption, are other enhancements applied in the proposed solution.

Another consideration in the proposed algorithm is the reduction of stall time which may occur due to sudden bandwidth drops below the lowest acceptable bit rate. Another policy is decreasing the playback quality level smoothly to reduce large quality changes and avoiding a resultant weak quality of experience (QoE).

Existing playback and regional radio area schemes frequently modify their playback quality due to periodic network bandwidth fluctuations. However, the proposed algorithm selects a fixed quality level, if there is no possibility of interruption. This approach results in a better quality of experience.

Simulation results, show the advantages of the proposed solution compared with the existing ones.

The remainder of this paper is organised as follows: Section 2, presents related work. Section 3 describes the proposed approach. Section 4 presents experimental results. Section 5 concludes the paper.

RELATED WORK

Dongeun Suh et al [see *"QoE-enhanced Adaptation Algorithm over DASH for Multimedia Streaming"*, IEEE, ICOIN 2014] proposed a QoE-Adaptation Algorithm over DASH (QAAD) that minimises video quality changes during bandwidth fluctuations and preserves the minimum buffer level to reduce the possibility of interruption. Experimental results in a DASH testbed show that when the available network bandwidth decreases sharply, QAAD reduces the quality level gracefully, to minimise the quality change of consecutive segments, and even if the available bandwidth fluctuates periodically, QAAD provides a stabilised level of quality. Miller et al [see *"Adaptation Algorithm for adaptive streaming over HTTP"*, Proceedings of IEEE Packet Video Workshop, 2012] describe an approach that divides the buffer into predefined thresholds ($B1, B2, B3, Bmax$) where ($B1 < B2 < B3 < Bmax$), and selects a video quality level based on the buffer level.

Rahman et al. [see *"An Efficient Rate Adaptation Algorithm for streaming over HTTP"*, IEEE, ICOIN 2018] propose an adaptation algorithm that selects the video quality level based on the estimated throughput and buffer level. Experimental results show that, when the available network bandwidth decreases sharply, the proposed algorithm suddenly reduces the quality

level and if the available bandwidth fluctuates, the proposed algorithm provides a stabilised quality level. Yaqoob et al [See "A DASH-based Efficient Throughput and Buffer Occupancy-based Adaptation Algorithm for Smooth Multimedia Streaming, IEEE, 2019"] describe a DASH-based throughput and buffer occupancy-based adaptation algorithm (TBOA) that selects the video quality level based on the estimated throughput and buffer level. In this approach, the playback buffer is divided into partitions based on predefined thresholds ($B0$, BL, BH) where ($B0 < BL < BH$). To select the bit rate in each segment, the current level is compared to these three mentioned levels.

PROPOSED ALGORITHM

In this section, the bandwidth estimation approach and the bitrate selection algorithm are described.

3.1   System model

First, it is worth mentioning some important notations in **Table 1**. Assume that a video file can be stored with at most n different quality levels in the streaming server. Consider these n video quality levels in the server are one of the members of $L = \{L1, L2,...,Ln\}$. Also consider that the video stream is divided into m segments, each containing Ts seconds of playback. To reach an acceptable QoE, the proposed Algorithm selects one quality level from the set L for each playing segment to adapt the video bitrate to the estimated throughput and playback buffer. $L1$ is the lowest quality level related to lowest bit rate and Ln is the highest quality level, related to highest bit rate in the set L based on the property of $b(La+1) > b(La)$. The adaptation Algorithm in DASH client consists of two parts:
1) Bandwidth Estimation Part; *and*
2) Bitrate Selection Part

TABLE 1 Summary of notation	
Notation	**Definition**
B_h	Pre-defined marginal buffer length.
B_{min}	Pre-defined minimal buffer length.
$Bufferth$	Pre-defined safe buffer length.
$Safeth$	Safe threshold
B_{avg}	Pre-defined safe buffer length
$B(t)$	Buffer length in video second at time t.
L	Set of the video quality levels.
L_{best}	Video quality level not exceeding the available bandwidth.
L_{pre}	Video quality level of the previously requested segment.
L_{next}	Video quality level of the next segment to be downloaded.
$b(L)$	Bitrate of the quality level L.
$T_{L, Bmin}$	Elapsed time to deplete the segments in the buffer while preserving the minimum buffer length B_{min} for the quality level L.
$T_{L, Bavg}$	Elapsed time to deplete the segments in the buffer while preserving B_{avg} level in buffer for the quality level L.
nL	The number of segments which can be downloaded without interruption for the quality level L.
L_{pb}	Pre-defined safe distance between quality levels.
T_s	Segment duration.
$BW_{estimated}$	Estimated bandwidth.

3.1.1 Bandwidth estimation

A client estimates the bandwidth of an upcoming segment based on the available bandwidth observed during downloading previous segments. The segment bandwidth BWrealtime is sampled in every T seconds and calculated as

$$BW_{realtime} = N/T \qquad (1)$$

where N is the size of data downloaded in T seconds. The estimated bandwidth is smoothed by means of a weighted moving average scheme as

$$BW_{estimated} = w \times BW_{estimated} + (1-w) \times BW_{realtime} \qquad (2)$$

where $BW_{estimated}$ is the previously estimated bandwidth and w is the weight factor for sampled bandwidth ($0 < w < 1$).

3.1.2 | Bitrate selection

After loading each segment, the bitrate selection module, selects the video quality level of the next segment, denoted by Lnext, based on available bandwidth BWestimated and the current buffer level B(t). On the other hand, Lbest represents the highest video quality level not exceeding the estimated network bandwidth and calculated as

$$L_{best} = argmax (b(L_a) \leqslant BW_{estimated}) \qquad (3)$$

Where $L_a \in L$.

The main objective of the bitrate selection scheme in the proposed approach is to minimise sudden decrease in the chosen bitrates for sustainable QoE. **Fig.1** shows the flow chart of the proposed algorithm. To determine the quality level of each segment, the current best quality level, L_{best} is compared to the previous quality level, L_{pre}. Decision is made based on comparing L_{best} with L_{pre} with the following possible results:
1) Mode 1: L_{best} is equal to L_{pre}.
2) Mode 2: L_{best} is higher than L_{pre}.
3) Mode 3: L_{best} is lower than L_{pre}.

1) Mode 1: ($L_{best} = L_{pre}$), in order to avoid reducing the buffer level and changing the quality level, L_{next} is set to the previous video quality level L_{pre}. However, to avoid interruption, the next quality level will be set to the lowest quality level L_1 if the current buffer level is less than B_{min}.

2) Mode 2: ($L_{best} > L_{pre}$), the current buffer level should be considered to reduce the effects of the bitrate fluctuation and unpredictable buffer level reduction. Therefore, L_{next} is incremented as $L_{pre}+1$ if the current buffer length is larger than the pre-defined marginal buffer length B_h. Otherwise L_{next} is set to minimum quality level L_1 only if the current buffer length is lower than the B_{min}. If none of the above conditions are met, L_{next} is set to the previous video quality level L_{pre}. Therefore, the buffer level will be higher than the marginal level and reduce the possibility of interruption when the current network bandwidth suddenly decreases.

3) Mode 3: ($L_{best} < L_{pre}$), the current available network bandwidth cannot keep the previous video quality level L_{pre}, unless the bandwidth drop is transient or low. Therefore, two modes should be considered:
Mode 3(a): If the distance between Lbest and the previous level is less than a certain threshold called Lpb, ($L_{pre} - L_{best} < L_{pb}$), the buffer level is greater than the Buffer threshold level ($Bufferth$), that is ($B(t) > Bufferth$) and fluctuate factor is lower than Safe threshold ($Safeth$), that is (*fluctuate factor* $\leqslant Safeth$), L_{next} is considered as previous level ($L_{next} = L_{pre}$).

The system enters this mode if the bandwidth is slightly reduced, instantaneous or fluctuating. As long as the bitrate selection part remains in this mode, *fluctuate factor* starts to increase in each run. However, after exiting this mode, the *fluctuate factor* will be reset.

In other words, each time the system enters this mode, the factor increases by one unit. and by exiting this mode and entering mode 1 or mode 2, the factor becomes zero.

$L_{best} = \max \{L, B(L) <= BW_{estimated}\}$
Mode1: if $L_{best} = L_{prev}$:
$\qquad L_{next} = L_{prev}$
$\qquad F = 0 , U = 0$

Mode2: if $L_{best} > L_{prev}$:
$\qquad$ if $B(t) > B_h$:
$\qquad L_{next} = L_{prev} + 1$
$\qquad$ else
$\qquad\qquad L_{next} = L_{prev}$
$\qquad\qquad F = 0, U = 0$

Mode3: if $L_{best} < L_{prev}$:
$\quad$ 3(a) if $\ B(t) \geqslant Bufferth$, $L_{prev} - L_{best} \leqslant L_{pb}$, $F \leqslant Safeth$:
$\qquad L_{next} = L_{prev}$, $F = F + 1$
$\quad$ 3(b) else
$\qquad$ 1) if $U = 0$: $B_{avg} = (B(t) + B_{min}) /2$, $l = B(t)$
$\qquad$ 2) $K = 0$
$\qquad$ 3) if $l \sim= B_{min}$, $k=2$:
$\qquad\qquad k = k-1$
$\qquad\qquad$ if $\ l = B(t)$: $\ l = B_{avg}$
$\qquad\qquad$ else : $\qquad l = B_{min}$
$\qquad\qquad$ if $n_{L,l} > 1$:
$\qquad\qquad\qquad L_{next} = L_{prev} - k$
$\qquad\qquad$ else
$\qquad\qquad\qquad k=k+1$, return to line 3 of 3(b)

FIGURE 1: *Proposed Algorithm (fluctuate factor and updatefactor are represented by F and U, respectively)*

The bitrate selection part can stay in this mode until fluctuate factor becomes lower than *Safeth*. An increase of fluctuate factor from *Safeth* indicates a successive decrease in bandwidth, therefore the system cannot remain in this mode and quality level reduction is required. On the other hand, during fixed small bandwidth fluctuations, the bandwidth is regularly decreasing and increasing. Therefore, the bitrate selection part regularly fluctuates between Mode 3(a) and mode 1 or 2 and mode 3(a) preserves the previous quality level in oscillating bandwidth condition.

Mode 3(b) : If the conditions of mode 3(a) are not met, a bitrate reduction is inevitable. However, lowering more than two levels at a time would result in significant QoE degradation. Therefore, by considering the buffer level, the bitrate selection part tries to keep the next quality level close to the previous quality level. To this end, the expected number of segments downloaded before reaching a certain buffer level should be calculated.

In multimedia streaming, the playback buffer pushes out one segment to decoder in *Ts* seconds. On the contrary, for the video quality level *l*, the playback buffer receives one segment from the network in $Ts \times b(l) / BW_{estimated}$ seconds.

Therefore, the changes in the playback buffer level due to the downloading of each segment, can be obtained from

$Diff = Ts \times b(l) / BW_{estimated} - Ts$ $\qquad\qquad$ (4)

On the other hand, $T_{L, l} = B(t) - l$ is the time available before the buffer reaches a certain level of buffer l.

Let $n_{L, l}$ be the expected number of segments downloaded during $T_{L, l}$. Then, $n_{L, l}$ can be computed as

$n_{L, l} = T_{L, l} / Diff$ $\qquad\qquad$ (5)

Where *Y* is a floor function that returns the largest integer

smaller than *Y*.

If the expected number of segments downloaded during $T_{L, l}$ is greater than or equal to 1, that is $n_{L, l} > 1$, the corresponding quality level *l* is defined as a feasible quality level.

If the buffer level is greater than B_{avg}, that is $(B(t) > B_{avg})$, by considering $l = B_{avg}$, the quality level that can be downloaded before reaching the B_{avg} buffer level is selected to reduce sudden quality change. Otherwise, by considering $l = B_{min}$, the quality level that can be downloaded before reaching the B_{min} buffer level is selected to prevent interruption.

In mode3(b), the distance between the current buffer level, $B(t)$, and the minimum buffer levels, B_{min}, is divided in two parts, if the updatefactor is reset.

The first part is considered from current buffer level to Bavg and the second part is considered from B_{avg} to B_{min}. The value of Bavg can be computed as

$B_{avg} = (B(t) - B_{min}) /2$ $\qquad\qquad$ (6)

The maximum feasible quality level lower than L_{pre} is searched by iterating the index k. To prevent lowering more than one level in quality, the previous quality level L_{pre} is first reduced by one level. If this level, $L_{pre} -1$, can be downloaded during T_L, B_{avg} seconds, the next level, L_{next} is set to this level ($L_{next} = L_{pre} -1$). Otherwise, this level will be reduced again by one level. If this level can be downloaded during the T_L, B_{min}, L_{next}, the selected level will be L_{pre}-2 ($L_{next} = L_{pre} -2$). Otherwise, this process continues while the quality level is reduced to ($L_{pre} - k$) which can be downloaded during T_L, B_{min}, where $n_{L_{pre},-k}$, $B_{min} > 1$.

Therefore, from quality levels lower than the previous level, the maximum quality level that can be downloaded before reaching the B_{avg} buffer level is selected. When the buffer reaches the B_{avg} level, the quality decreases by one level to prevent sudden changes in the quality level and the maximum quality that can be downloaded before reaching the B_{min} buffer level is selected.

As long as the system remains in this mode, the *updatefactor* will increase and B_{avg} will remain unchanged. Therefore, if system exits this mode and enters another mode, the *updatefactor* will reset.

By considering the T_L, B_{avg} time, system can smoothly reduce the bit rate and prevent instantaneous changes in quality level during times of sudden bandwidth fluctuations.

EXPERIMENTAL RESULT
The proposed algorithm is simulated in MATLAB as follows. The first video segment is fetched with the lowest bit rate. Fifteen different quality versions of the big buck bunny [see http://www. bigbuckbunny.org/] movie is then created. After that, Ffmpeg [see http://ffmpeg.org] is applied to encode the original video file with encoding rates of 45 kbps (quality 1), 89 kbps (quality 2), 131 kbps (quality 3), 178 kbps (quality 4), 221 kbps (quality 5), 263 kbps (quality 6), 334 kbps (quality 7), 396 kbps (quality 8), 522 kbps (quality 9), 595 kbps (quality 10), 791 kbps (quality 11), 1033 kbps (quality 12), 1245 kbps (quality 13), 1547 kbps (quality 14) and 2134 kbps (quality 15).

Each video stream is multiplexed with a common 128 kbps audio file to form a corresponding single MPEG-2 TS stream. Each stream is divided into 2-second segments. We set the weight factor w and the estimation period T to 0.8 and 0.3 seconds, respectively. Also, the pre-defined marginal buffer length, the minimum buffer length and buffer length are set to 10 seconds, 3*Ts seconds and 30 seconds, respectively. The

Bufferth and *Safeth* are set to 15 seconds as half of buffer length, and One-fifth of number of quality levels 3. The safe distance L_{pb} is also set to 4 levels.

The performance of the proposed approach is evaluated in comparison with that of QAAD, URrahman and TBOA Algorithms. The performance is evaluated in terms of four video quality metrics: average video bitrate, number of video quality switches, weighted changes in quality levels shown with a parameter called Reward [see *"Optimizing HTTP-Based Adaptive Streaming in Vehicular Environment Using Markov Decision Process"* IEEE TRANSACTIONS ON MULTIMEDIA, 2015] and playback interruptions. The reward parameter represents the amount of large and sudden changes. With higher quality level changes, greater weight will be assigned to it. Therefore, the greater reward parameter, indicates smaller QoE.

Table 2 shows the weights assigned to each incremental change in quality level. *Table 3* shows the weights assigned to each reduction in quality level. As shown in *Tables 2* and *3*: The larger the change, the more weight is assigned to it.

TABLE 2 Weights assigned to each incremental change

Level change	0	1	2	3	4	5	6	7
Weight	0	1	5	10	25	50	100	150

Level change	8	9	10	11	12	13	14	
Weight	250	350	500	750	900	1100	1300	

TABLE 3 Weights assigned to each decreasing change

Level change	0	1	2	3	4	5	6	7
Weight	0	10	50	250	500	1000	1500	2200

Level change	8	9	10	11	12	13	14	
Weight	3000	3900	5500	6300	7900	9800	11800	

In the experiment scenario, four types of bandwidth stress test are conducted: 1) step-down test (Bw1), 2) stable and constant change test (Bw2), 3) fluctuation test (Bw3) and 4) mobile bandwidth test (Bw4).

In the step-down test, the available bandwidth is reduced from 1600 Kbps to 45 Kbps. On the other hand, in the fluctuation test, the available bandwidth is fluctuated repeatedly every 4 seconds from 1800 Kbps to 1000 Kbps and again 1000 Kbps to 1800 Kbps. In a stable and constant test, bandwidth changes from 2000 Kbps to 1000 Kbps after the first 100s and then switches repeatedly between 1000 Kbps and 500 kbps every 50s until the end of simulation at 300 seconds. In a mobile test, bandwidth changes randomly from 3000 Kbps to 300 Kbps.

4.1   Single client scenario

Quality of experience parameters for the proposed approach and three other approaches are shown in **Table 4**.

First, the step-down bandwidth is considered. The video bitrates for the proposed approach, TBOA, URrahman and QAAD are shown in **Fig. 2**. TBOA requests higher bitrates than other approaches at the beginning of the experiment. The reason is that other approaches try to support the confident marginal buffer length. Therefore, TBOA leads to the maximum stall time.

Second, the adaptive behaviour of the bitrate selection part, in case of stable and constant bandwidth change, is shown in **Fig. 3**. Proposed approach achieves a high average video bitrate,

least quality change and the least reward in comparison to other schemes. QAAD has lowest video bitrate and URrahman has the largest number of video quality switches.

Third, a bandwidth fluctuation is considered. The video bitrates for the proposed approach, TBOA, URrahman and QAAD are shown in **Fig. 4**. The proposed approach and URrahman have a stable response to short-term periodic bandwidth variations with the least amount of video quality switches and reward.

Fourth, a mobile bandwidth is considered. The video bitrates for proposed Approach, TBOA, URrahman and QAAD are shown in **Fig. 5**. Proposed approach and TBOA achieve a high average video bitrate. As shown in **Fig. 5**. By decreasing the bandwidth in 226 to 280 seconds, the proposed approach slowly reduces the quality level to prevent large changes, while other approaches constantly change the quality level.

TABLE 4   *Statistic of different adaptation Algorithm*

approach	Proposed approach			
BW	Bw1	Bw2	Bw3	Bw4
Video rate avg (kbps)	373	745	1014	1400
Number of change	24	21	13	62
Time of stall (seconds)	8.3	0	0	0
Reward	9811	104	33	297

approach	QAAD			
BW	Bw1	Bw2	Bw3	Bw4
Video rate avg (kbps)	373	595	858	1360
Number of change	24	23	86	103
Time of stall (seconds)	8.3	0	0	91
Reward	9811	104	264	528

approach	TBOA			
BW	Bw1	Bw2	Bw3	Bw4
Video rate avg (kbps)	584	765	1140	1400
Number of change	28	23	80	210
Time of stall (seconds)	23.1	0	0	2.9
Reward	10323	1313	2419	35281

approach	URrahman approach			
BW	Bw1	Bw2	Bw3	Bw4
Video rate avg (kbps)	334	705	935	1360
Number of change	24	72	13	38
Time of stall (seconds)	4	0	0	2.6
Reward	9821	21669	21	12111

FIGURE 2 *Step-down test*

FEATURE ARTICLE 1
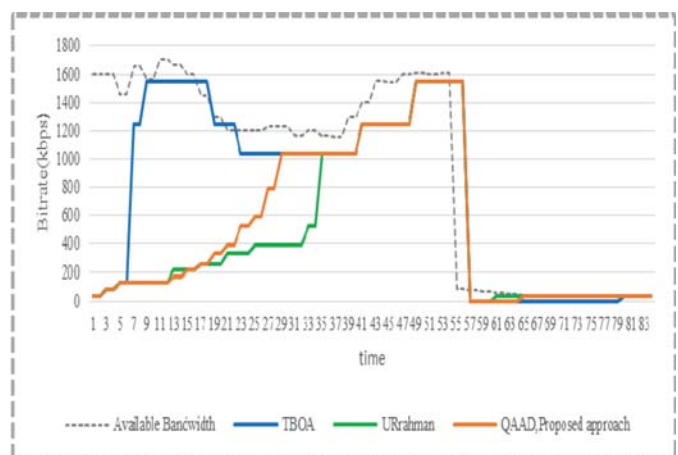
FIGURE 3 *Stable and constant change test*
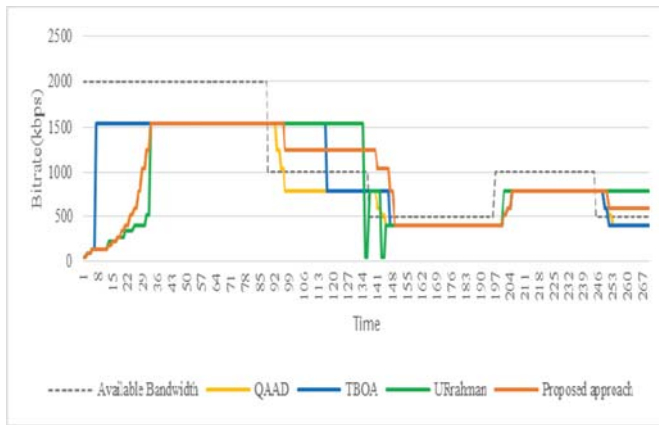
FIGURE 4 *Fluctuation test*
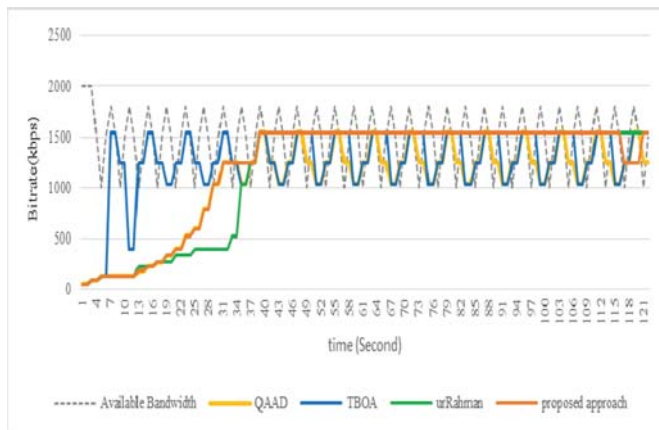
FIGURE 5 *Mobile bandwidth test*

TABLE 5 *Statistic of different adaptation Algorithm*

approach	Proposed approach – QAAD			
BW	Bw1	Bw2	Bw3	Bw4
Video rate avg. (kbps)	0	50	156	40
Number of changes	0	-2	-73	-41
Time of stall (seconds)	0	0	0	0
Reward	0	0	-231	-231

approach	Proposed approach – TBOA			
BW	Bw1	Bw2	Bw3	Bw4
Video rate avg. (kbps)	-211	-20	-126	0
Number of changes	-4	-2	-67	-148
Time of stall (seconds)	-14.8	0	0	-2.9
Reward	-512	-1206	-2386	-34984

approach	Proposed approach – URrahman			
BW	Bw1	Bw2	Bw3	Bw4
Video rate avg. (kbps)	39	40	79	40
Number of changes	0	-51	0	24
Time of stall (seconds)	4	0	0	-2.6
Reward	-10	-21565	12	-11814

CONCLUSION

In this paper, a rate adaptation algorithm for HTTP adaptive streaming was proposed that improves QoE by preventing playback interruption and reducing sudden and large changes in quality level during playback.

The quality assessment of the proposed algorithm was done in comparison with existing solutions, in terms of four quality metrics, i.e., video quality level, number of video quality switches, number of sudden video quality switches, and the stall time.

The Proposed Algorithm outperformed the other approaches under various network bandwidth conditions, by attaining a high video bitrate, reducing video bitrate change, smoother changes in quality level and reducing stall time, all resulting in better QoE.

Table 5 shows the difference of the quality of experience parameters in the proposed method compared to other approaches.

In general, the proposed approach has better performance in terms of quality level changes and reward than other approaches and has better performance in terms of average quality level than URrahman and QAAD approaches.

The TBOA has better performance in terms of average quality level than other approaches, because it selects high quality levels at the beginning of the playback. However, it has the worst performance in terms of stall time and reward than other approaches.

AUTHORS

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Linear Television Broadcasting over 5G Networks, Part 1: Spectrum Considerations

by **Dr. Les Sabel** (S-Comm Technologies); **Peter Walop** (Convergence Consulting Company)

ABSTRACT

This article addresses the spectrum demands for carrying linear TV services over 5G mobile networks.

It is important to note that this article focusses on the terrestrial delivery of *linear television services* over 5G networks. These linear television services are typically delivered by High-Power High-Tower (HPHT) networks, commonly referred to as terrestrial broadcasting networks, and are often Free-To-Air (FTA). The delivery of Video-On-Demand (VOD) services are not addressed in this article.

In an associated article of both authors, titled *Linear Television Broadcasting over 5G Networks, Part 2: Regulatory and Business Considerations*, having a supporting regulatory and licensing framework, as well as having a viable business case for 5G based broadcasting, are addressed.

INTRODUCTION

Renewed efforts from the telecom and broadcasting industry to deliver linear television services using mobile cellular technology networks have recently gained traction again. Dating back as far as the early 2000s, technologies such as DVB-H, MediaFlow, T-DMB and ATSC-M/H had limited business success. The capability to deliver linear television services over FeMBMS enabled LTE/5G networks, as defined in 3GPP releases 14/16 and labelled 5G Broadcast (5G BC), may be more promising. The definition of FeMBMS now includes additional 5G numerologies and significantly larger OFDM Guard Intervals to allow networks to operate in Single Frequency Network (SFN) modes.

Several experiments and studies on the structure and use of 5G BC have been carried out, such as those reported in documents including ETSI TS 103 720 and EN 302 296 and EBU documents TR054, TR063 and TR064. Although this article builds on the experiences gained, it focusses on the terrestrial delivery of *linear television services* over 5G based networks.

Preparations for the World Radio Conference of 2023 (WRC-23) are now well underway as the industry currently debates the possibility of migrating large parts of terrestrial television services to 5G networks. WRC-23 Agenda Item 1.5 addresses possible changes to the use of the 470 - 694 MHz band in ITU Region 1 to allow 5G service operation. The USA, in ITU Region 2, has cleared 84 MHz of digital television (DTV) spectrum in the UHF 600 MHz band for mobile use. It is noted that for ITU Region 3, the 600 MHz band is not being considered in the forthcoming WRC-23.

Given this background of new 5G technology developments and the global spectrum management agenda of WRC-23, this article addresses the spectrum demands for carrying linear TV services over 5G mobile networks.

SPECTRUM DEMANDS FOR TV OVER 5G NETWORKS

In this Part 1, we first examine what spectrum is needed to deliver linear or FTA television services, using unicast mode over 5G mobile networks. Secondly, we consider the alternative of delivering FTA services over dedicated 5G BC networks.

5G UNICAST DELIVERY

It is important to note that in this analysis of 5G unicast delivery we do not consider the needs of other traffic. Only the spectrum bandwidth that would be required for the carriage of FTA television services at peak hours is considered.

For calculating the spectrum demands for carrying FTA services over a 5G unicast network, we first model the FTA viewing situation, followed by defining the bitrate requirements for the various types of FTA service and model the spectral efficiency of 5G services. With these three sets of assumptions, we calculate the spectrum demands for the various scenarios.

VIEWING SITUATIONS

Assuming a large city population of 5 million, which requires approximately 1,000 mobile phone cells, implies that on average there are 5,000 people per cell, the major MNO's in Sydney Australia being examples.

Viewing of FTA services are not equal during a day and tends to peak in the morning and early evening when the daily news and current affairs programs are delivered, typically between 7 and 9 am and 5 and 7:30 pm in most countries. Hence, we need to calculate the traffic for these peak hours. Different viewing scenarios at these peak hours are compared, as defined in *Table 1* below. We have assumed an average household size of four people. With 5,000 people per cell this assumption results in 1,250 households per cell.

Viewing scenario	Household viewing situation	Percentage of Households with given viewing situation in each cell	Number of unicast streams per cell, at peak hour
1	4 people, each viewing a different FTA service, at peak hour.	100%, all households	5,000
2	4 people, all viewing the same FTA service, at peak hour	As above	1,250
3	As above	50%	625
4	As above	25%	312

Table 1: Viewing scenarios

BIT RATE REQUIREMENTS PER TYPE OF SERVICE

For determining the required bitrates per type of service, we need to select the applied video encoding standard. To date the highest efficiency video coding scheme used in digital broadcasting is H.265/High Efficiency Video Coding (HEVC) which is more efficient than the more commonly used H.264/Advanced Video Coding (AVC) scheme. H.264 is used in DVB-T while H.265 is used in DVB-T2 and ATSC-3.0. Recent developments in video coding have resulted in the H.266/Versatile Video Coding (VVC) standard which claims to reduce the required bitrate relative to H.265 by 40% to 50% for UHD and 8k resolutions [1] and slightly less around 30% for HD and SD. The VVC codec is currently being integrated into the DVB-T2 and ATSC 3.0 standards and is also gradually getting acceptance for streaming and video playback applications.

For setting the required bit rates, we use in this article the H.265/HEVC and H.266/VVC standards, noting that the latter does not have any commercial applications yet. **Table 2** shows the required bit rates per FTA service type for the two encoding standards.

Resolution		Bitrate (H.265) (Mbps)	Bitrate (H.266) (Mbps)
UHD (4K)	3840 x 2160	16	8
FHD (2K)	1920 x 1080	8	4
HD (HD ready)	1280 x 720	4	2
SD	720 x 576	2	1

Table 2: Required bit rates per FTA service type

For the values in **Table 2** we have used average bit rate values for delivering the various television services to TV screen sizes greater than 48" [2]. It is noted that the different providers use varying bitrates, as the required bit rates are not only dependent on the picture resolution but are also dependent on the number of frames per second, HDR/colour method and encoding technology applied.

5G SPECTRAL EFFICIENCY

We study the bandwidth requirements of the average cell considering different modulation orders. The details of 5G spectral efficiency provided by different modulation and Forward Error Correction (FEC) coding are defined in [3] table 5.1.3.1 and summarised in **Table 3** below, using the mean FEC rate for each modulation order.

Modulation	Spectral efficiency using mean FEC rate (bps/Hz)
QPSK	0.71
16QAM	2.02
64QAM	3.92
256QAM	6.37

*Table 3: Modulation orders and spectral efficiency (non-MIMO)*

We find in the ITU 5G evaluation report [4] that under realistic conditions for mobility that the spectral efficiency values will generally be lower than the maximum values available. The values as provided in [4] do not include any overheads which may reduce the video payload capacity. For our estimation of the required bandwidth for carrying FTA services, we use two scenarios. For the first case we assume a roof-top antenna and a high spectral efficiency of 6 bps/Hz which corresponds to using 256 QAM modulation and a code rate of 0.73 [3] and which is very close to the 0.75 code rate used in DVB-T2. For the second case we consider the mobile and indoor scenario assuming a more robust spectral efficiency of 3 bps/Hz which corresponds to 64 QAM and a code rate of 0.5 [3]. We do not include any additional gain

which may be provided by Multiple Input Multiple Output (MIMO) techniques due to the difficulty of implementation in the sub-1 GHz band. Finally, we use a frequency reuse ratio of 3 as the standard case for macro/micro cells in a cellular network.

CALCULATION RESULTS

The resulting requirements for the average bandwidth (in GHz) per network cell, under the different viewing scenarios (numbered 1 to 4) and FTA service types (UHD and HD), are shown in **Figure 1** for the current H.265/HEVC codec and in **Figure 2** for the new H.266/VVC codec.

Figure 1: Total bandwidth (in GHz) per cell for unicast delivery using H.265/HEVC video codin
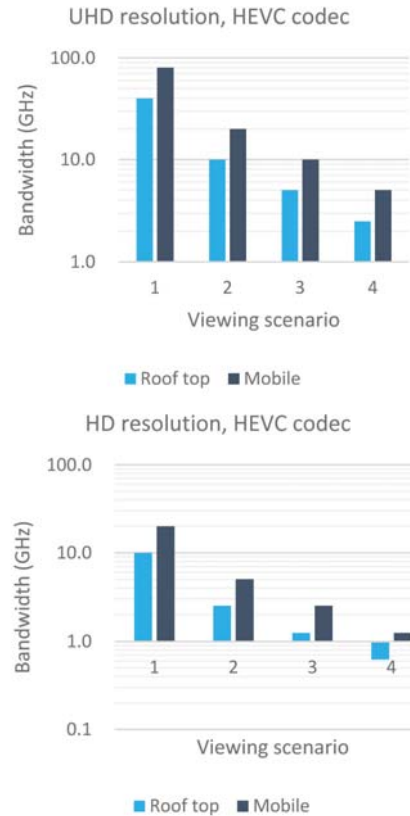
Figure 2: Total bandwidth (in GHz) per cell for unicast delivery using H.266/VVC video coding
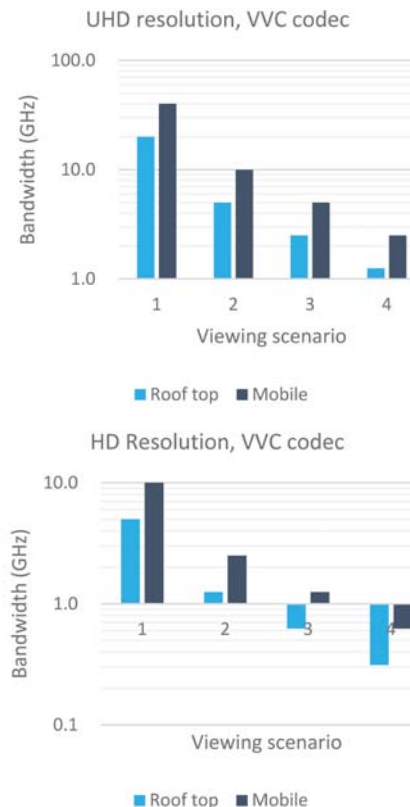
From the left graph in **Figure 1**, for delivering UHD services under viewing scenario one when using the current HEVC video codec, we see that the required bandwidth is 40 and 80 GHz respectively for rooftop and mobile reception, an amount of spectrum that even millimetre wave bands could not support. The right graph in **Figure 1** shows that for viewing scenario three and delivering HD services, the bandwidth requirement is 1.3 and 2.5 GHz respectively for rooftop and mobile reception. Such a spectrum demand is also highly unlikely to be supported, even by using all the sub-6 GHz frequency bands.

Given these high bandwidth requirements we now examine the ability of the three individual mobile frequency bands (the sub-1 GHz band, mid bands (1 to 5 GHz) and millimetre wave bands (typically above 20 GHz)) to deliver FTA services.

For the sub-1 GHz, 5G can cover cells of 2 km radius. There is approximately 250 MHz of paired spectrum, or 125 MHz of downlink spectrum in the range from 600 MHz to 1 GHz (country dependent). Sub-1 GHz spectrum is very valuable for use in macro cells and rural situations. The analysis shows that even for the most lenient case of viewing scenario four and the use of H.266/VVC codec for HD resolution video, the sub-1 GHz spectrum is unable to support the demand of 300 and 600 MHz respectively for rooftop and mobile reception.

Alternatively, the lower mid-band frequencies may also be able to cover cells with 2 km radius and in this lower mid-band range there is around 0.5 GHz of downlink spectrum available, and then a further 1 to 1.5 GHz in the upper mid-band range. However, it is unlikely that those frequencies will be able to provide in-building support for high bitrate services near the edge of the cell. In both cases (below 1 GHz and mid-band) there is insufficient spectrum to support all UHD services, even with limited viewing like in viewing scenario 4. It is likely that there will be a mix of UHD and HD/SD in various use cases including rooftop and mobile reception, however the resulting demand at peak hours is likely to exceed the bandwidth availability in the combined sub-1 GHz and mid-range bands, even when excluding other traffic.

The high-band frequencies, typically above 20 GHz and up to 70 GHz, have substantially more spectrum. In total up to 18 GHz could be made available in this frequency range over time. These frequencies however suffer from significantly higher losses with typical cell radius of less than 500m with reasonable traffic loads. In other words, the use of the high-band frequencies is likely to require around 20 sites within the 2 km cell radius.

In summary, even with higher operating frequencies and the latest encoding technologies 5G unicast will struggle to deliver all FTA services and the cost to MNOs will be enormous, let alone the unsightly impact of the significant increase in antenna sites. Furthermore, the rollout of that many sites will take many years, if it is at all viable.

5G BROADCAST DELIVERY

The 3GPP introduced changes to the 5G BC system in Releases 14/16 which provide near equivalence in spectral efficiency of 5G BC and Digital Terrestrial Television Broadcasting (DTTB) systems such as DVB-T2/ATSC 3.0. In terms of best-case reception, such as rooftop reception, both systems are theoretically close to the Shannon limit.

We note that when 5G BC is consumed in a mobile, indoor and Non Line Of Sight (NLOS) reception areas, which applies for most mobile use cases, then the usable Modulation and Coding Scheme (MCS) combinations moves to the lower end of the spectral efficiency.

Given transmission power allocation to achieve coverage using

rooftop reception, the area which would receive viable mobile coverage is vastly decreased by to additional losses due to receiver height, antenna gain, building entry losses and mobility as 5G BC does not currently include any time interleaving.

These DTTB systems are commonly deployed in the UHF band. In Europe the band 470 - 698 MHz (228 MHz) is allocated to broadcasting services, whereas in the USA the band 470 - 608 MHz (138 MHz) is in use for terrestrial broadcasting as the 600MHz spectrum was previously allocated to mobile services. A 5G BC network would operate in the same UHF bands.

With 5G unicast the number of simultaneous streaming sessions (at peak hour) drives the spectrum needed, independent from the number of television services. In contrast, with 5G (or DTT) broadcast delivery the number of television services is limited by the amount of spectrum that is available. We can estimate the maximum number of services which can be provided in the current spectrum using a few basic assumptions.

From DTTB network planning in the various countries, we know that the frequency re-use factor ranges between 3 to 6 for deploying national services for achieving 95% population coverage. These frequency re-use factors can be achieved by deploying as much as possible Single Frequency Networks (SFNs). We use 5 as a mean frequency reuse factor value as suggested in [5], this gives us a maximum bandwidth of 45.6 MHz (228 MHz/5) per area in Europe and 27.6 MHz (138 MHz/5) in the USA.

Using the numbers in [6] table 5 for DVB-T2 spectral efficiency we obtain the values for the average number of services available in an area for the case of fixed rooftop antenna (256QAM) and portable receivers (64QAM) as shown in **Figure 3** for Europe and the USA for the case of HEVC coding while **Figure 4** covers the case of VVC coding.

Figure 3: Average number of services per area when using the H.265/HEVC codec – left = Europe, right = USA
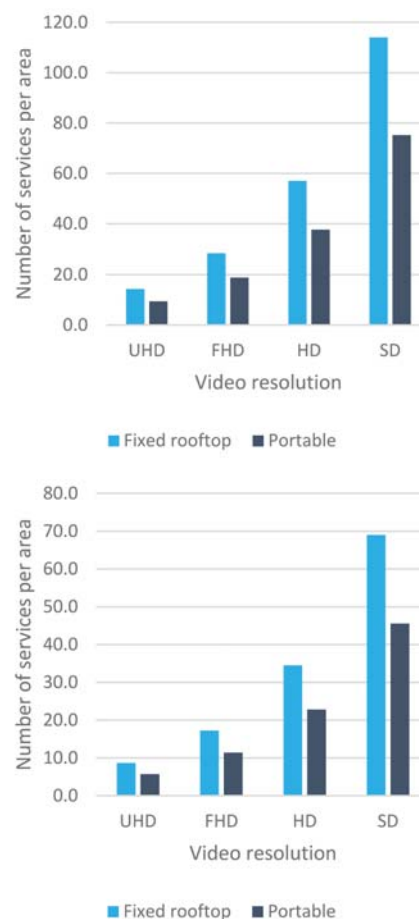
Figure 4: Average number of services per area when using the H.266/VVC codec – left = Europe, right = USA

Fixed rooftop ■ **Portable**

Fixed rooftop ■ **Portable**
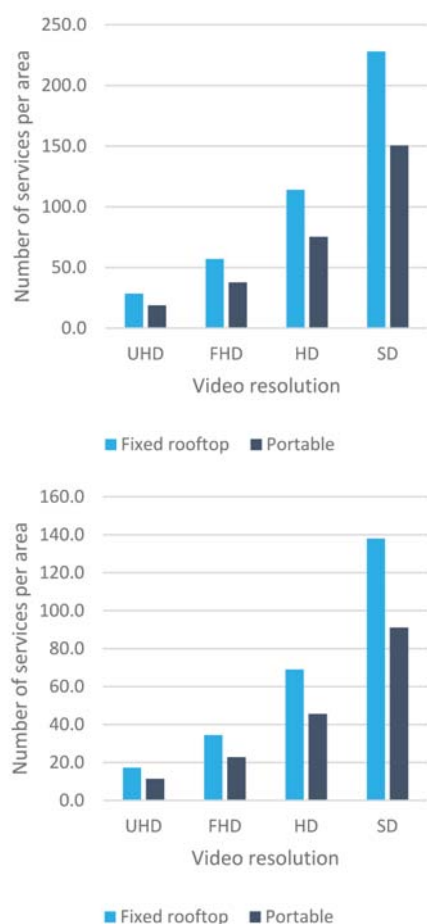
When using HEVC video coding, **Figure 3** shows that for Europe the number of UHD services will be 14 if rooftop reception is assumed, and 9 if portable reception is assumed, noting that portable indoor reception may be difficult in some situations due to building entry propagation losses. In contrast the number of UHD increases to 28 and 18 for the future case of VVC, as shown in **Figure 4**. The situation in the USA is similar but scaled to lower values as less bandwidth is available.

Given that there are already significant numbers of FTA services in Europe and the USA, where 2nd generation DTTB is available, the options for introducing UHD services are limited because a single UHD transmission will require approximately 8 times more bitrate as a SD service. As the 2nd generation transmission standards are already close to the Shannon limit, any technical improvement for carrying more UHD services will have to come from better video coding.

While it may be possible to improve video coding efficiency beyond VVC, the introduction of a further codec will take considerable time considering that H.266/VVC is still in the implementation process and no receivers are commercially available yet.

While it is likely that there will be some limited UHD services offered for prime content such as international sports like the Olympic Games it is also likely that there will be an ongoing mix of HD and SD services to support different service content types. As television services migrate to UHD and demand increases for these service types even with the widespread use of H.266/VVC, it is likely that programming of films and TV shows will increasingly be consumed through VOD streaming using both fixed and mobile networks. This supports the assertion that FTA TV will increasingly focus on news, sports and live events.

CONCLUSIONS

This article demonstrated that delivering all FTA services over 5G unicast is not a feasible option as such a solution would require significantly more than the available spectrum. FTA services delivered over 5G BC is technically not different from DTTB delivery in terms of spectrum efficiency, as both solutions are OFDM based and near the Shannon limit.

Hence, 5G based broadcasting should not be viewed as a DTTB replacement. A better model would be to combine DTTB broadcasting with 5G network services, whereby DTTB would focus on FTA service delivery, albeit with a smaller number of services in UHD quality. 5G networks would continue to deliver VOD services, whereby 5G BC can be deployed as an advanced traffic management tool to further increase the capacity of mobile networks.

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Peter Walop, Executive Partner, Convergence Consultant Company

Peter Walop has over 25 years of working experience in the broadcasting and telecommunications markets. As a consultant, Peter assisted telecom operators, broadcasters, and regulators with the introduction of telecom and digital broadcasting services in a wide range of countries, including Angola, Belgium, Bhutan, Burundi, Cambodia, Denmark, Ethiopia, France, the Gambia, Germany, India, Jamaica, Japan, Luxembourg, Malaysia, The Netherlands, Norway, Rwanda, Serbia, Spain, Sweden, Switzerland, Thailand, Uganda, and Vietnam. ■

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ELEVATE BROADCAST

ABU DBS 2022

EVOLVING MEDIA WORKFLOWS
21-24 MARCH 2022
A VIRTUAL EVENT

EVOLVING MEDIA WORKFLOWS

The 18th ABU Digital Broadcasting Symposium (DBS 2022) was organized as a virtual event from the 21-24 March 2022. With the engaging theme **"Evolving Media Workflows"**, the symposium sessions addressed new technologies and development in the areas of IP technologies, remote productions, AI and bigdata, online delivery platforms and Cybersecurity among others. The 4-day event with 12 conference sessions and 5 focused workshops presented by over 65 experts, attracted more than 1000 participants from 92 countries representing 345 organisations

1036 participants

345 organisations

92 countries

12 conference sessions

5 workshops

over **50** topics/discussions

65 speakers/experts

Top 10 countries by participation

(Malaysia, India, Singapore, China, Japan, Pakistan, Iran, Thailand, Turkey, Philippines)

Top 10 organisations by participation

(RTM, VU, IRIB, TRT, NHK, IPSB, CGTN, MYTV, Mediacorp, Prasar Bharati (AIR/DDI))
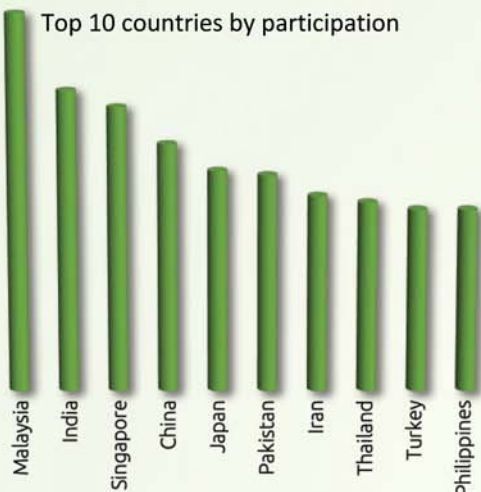
2022 ABU DIGITAL BROADCAST SYMPOSIUM | 21-24 MARCH 2022

WELCOME ADDRESS
Dr Javad Mottaghi, Secretary-General, Asia-Pacific Broadcasting Union

OPENING ADDRESS
Mr Shashi Shekhar Vempati, Vice President, Asia-Pacific Broadcasting Union, Chief Executive Officer, Prasar Bharati-India

INDUSTRY KEYNOTE
Mr Mohamad Helmi Harith, Group Chief Executive Officer, Altel Holdings

The 2022 ABU DIGITAL BROADCAST SYMPOSIUM was held virtually from 21-24 March 2022 and streamed to participants worldwide through Internet lines, from the Asia-Pacific Broadcasting Union (ABU) building in Kuala Lumpur. This annual symposium, which, is usually held physically in Kuala Lumpur, was conducted virtually in 2021, and again this year, because of the ongoing pandemic. The welcoming remarks were made by **Dr Javad Mottaghi**, Secretary-General, ABU while the opening address was delivered by **Mr Shashi Shekhar Vempati**, Vice President, ABU and Chief Executive Officer, Prasar Bharati-India. **Mr Mohamad Helmi Harith**, Group Chief Executive Officer, Altel Holdings introduced the industry keynote. The 4-day symposium, aptly themed 'Evolving Media Workflows', provided ample opportunities for participants to have access to information on all the various aspects of broadcasting, ranging from 5G to IP. The symposium attracted many participants, representing broadcasters, telcos, regulators, manufacturers and other industry players.

INDUSTRY DEVELOPMENTS AND STANDARDS UPDATE

The first session was moderated by **Hamid Dehghan Nayeri**, IRIB-Iran and the panelists were **Ruxandra Obreja**, DRM Consortium; **Lindsay Cornell**, BBC Digital; **Tom Christophory**, SES; **Régis Moulin**, Eutelsat and **Fintan Mc Kiernan**, IDEAL Systems.

DAB+ has firmly established itself as the core future platform for radio in Europe. Further progress in Europe is being driven by the European Electronic Communications Code, which makes it mandatory for new cars to be installed

with digital terrestrial radio, and DAB+ is now standard in the majority of these cars. Over 80% of consumers are less likely to buy or lease cars without a built-in radio tuner and they want free access to broadcast radio. The most desired radio features include voice controls and content information. DAB+ consumes significantly less energy than FM and a study by the BBC shows DAB to be 33% more efficient than FM. DAB+ preserves the core strengths of traditional broadcast radio which are Free to Air, with no gatekeepers, and is reliable in times of emergency. The specification for Hybrid Radio Service and Programme Information or ETSI TS 102 818 has been

updated to enhance the user experience. Voice control assistance includes alternative names for radio stations as well as phoneme support for station and programme names. Additional metadata is added to provide details of contributors, presenters and creators.

DRM serves all coverage needs, with AM bands providing large area coverage and FM bands providing local coverage. There has been a resurgence of SW receivers, as HF transmission is resilient with good propagation parameters at low power, making it difficult to jam. DRM may be considered the successor to analogue AM and FM. It can reach out to all

citizens in a country whether they live in bigger cities, in villages, on hills or in valleys. It uses a single technical standard acting as a single solution for local, regional, national and international radio services. DRM utilizes spectrum more efficiently at much reduced costs and it is also multilingual with on demand information/text.

DRM can offer education and information to people no matter where their location, or during a pandemic or crisis. Education is provided free to air for everybody without the need for Internet. The receivers can cache information for convenient access at any time, even during the night. DRM consortium, in partnership with other organisations, is embarking on a distance learning project in a school based in West Africa.

DVB Native IP, enabling the convergence of broadcast and OTT technologies, is a new specification in the DVB Toolbox. It is best to broadcast in IP, instead of relying on the MPEG Transport Standard. IP is compatible with all modern end devices and screen sizes and can seamlessly blend broadcast and OTT delivery. The net result of using DVB-NIP is more flexibility, interoperability at lower cost. NIP increases broadcast reach to all devices at home and not just STBs, allowing broadcasters to benefit from data analytics.

The specification eases the technical provisioning of targeted advertising. Large scale distribution of identical video content via OTT is inefficient because of wastage of resources such as servers, CPU time, storage and networking. DVB-NIP provides the path towards a full IP broadcast ecosystem, blending the latest generation OTT and Broadcast Technologies.

Network Device Interface (NDI) is a royalty free software specification that enables video compatible products to communicate, deliver, and receive high-definition video over a standard computer network. It is of high quality, low latency, frame accurate and suitable for switching in a live production environment.

Standard Digital Interface (SDI) is confined to professional video equipment and caters for a unidirectional single video channel. In contrast, NDI is bidirectional and can be used with standard IT equipment. It caters for multiple HD video channels with lower costs when compared to SMPTE 2110.

ZHONG SHI

Mardhiah Nasir

Joan Warner

Simon Keens

EVOLVING BUSINESS STRATEGIES FOR BROADCAST AND MEDIA

The moderator was **Zhong Shi**, China Global Television Networks (CGTNs) and with panellists comprising **Mardhiah Nasir**, IPSB Technology; **Joan Warner**, Commercial Radio Australia and **Simon Keens**, Ampegon Power Electronics.

OTT has various models, namely Subscription Video on Demand (SVOD), Advertisement based Video on Demand (AVOD) and Transactional Video on Demand (TVOD). SVOD offers unlimited access for a monthly fee, provides recurring revenue and is the most popular streaming model, but viewership is starting to decline. AVOD offers free access but is advertisement supported and revenue is based on views. It is gaining popularity especially among certain demographics. TVOD is pay by title and is the most common with premium or exclusive content. Convergence of these models has resulted in Free Advertisement-Supported

TV (FAST), appearing not only in Malaysia but also the rest of the world. Another driver for this convergence is illegal viewing which has been costing the industry billions of dollars. However, Malaysia's anti-piracy efforts showed a decrease of 64% in the number of consumers accessing pirated services in 2020. Twenty percent of those who stopped, became paying subscribers whilst the remaining 80% switched to advertisement supported services.

In Australia, commercial radio grew, with a record high of 11.2 million listeners tuning in each week. This represented a strong audience growth of 1 million listeners (9.3%) over the past 5 years. Commercial radio reached 76.3% of all Australians and the average weekly time listening to commercial radio was almost 13 hours. DAB+ is available in 5 major metros and four regions and will be soon available at the Gold Coast. DAB+ provides a significant choice of content and builds incremental audiences and revenue growth for broadcasters. There are now over 350 DAB+ and AM/FM stations on the radio app, representing robust growth over ten years.

Car manufacturers are looking to invest in developing connected services in the car dashboard and may cut costs elsewhere, affecting the radio receiver that is to be installed in the car. There's a real possibility that radio in the connected car may not be easily accessible. Hence, a survey of global consumers was conducted, asking them how much they value radio in the car. Almost all of them agreed that a broadcast radio tuner should be standard equipment in every car. Prospective buyers have indicated that they are less likely to buy or lease a car that does not have an inbuilt radio.

The RF carrier in analogue AM broadcast consumes 66% of effective radiated power (ERP) of the transmitter but does not carry information content. The upper and lower sidebands carry content but consume less than 33% of ERP demonstrating that analogue AM is an inefficient method of transmitting radio

signals. A 100 kW MW Transmitter can provide an area coverage of 235,000 sq km whereas a DRM transmitter with a rating of 40 kW can cover the same area. An analogue Medium Wave (MW) transmitter with 100 kW ERP may have 72% efficiency and consume 142 kW electrical power which is less efficient than the 40 kW ERP DRM transmitter having 80% efficiency and 50 kW electrical power consumption. Another advantage of DRM is that three radio services with multimedia content can be provided, compared to the single service of an analogue transmitter.

In the case of FM bands, a DRM Transmitter with a rating of 1 kW can deliver three services, which is one tenth of that of a single analogue FM transmitter with a rating of 10 kW delivering a single channel. Therefore, the costs of migration from analogue to DRM can be recovered by the substantial savings in energy cost. Further savings can be calculated from the reduction in cooling requirements, floor space, maintenance, and signal distribution.

MEDIA SOLUTIONS: IMPLEMENTATION AND USE CASES

The session was moderated by **Aale Raza**, Whiteways Systems, and the panellists were **Ahmad Shafiq Mirza Mansor**, RTM; **Pan Ming**, 5G iMango Radio; **Nurulhusna Mohamad Kasim**, RTM and **Martin Webb**, Comcast Technology Solutions.

Mobile journalism is an emerging form of new media storytelling, where reporters use portable electronic devices with network connectivity in order to gather, edit and distribute information. Smart phones can be a good choice for journalists creating news video, radio and multi-platform stories.

Song arrangement is labour intensive

operation and complicated by individual preferences of radio studio staff or anchor persons. Algorithms based on convolutional neural networks can arrange songs suited towards the different programme styles of the anchors, saving time and costs. The preferences of audiences can be satisfied, and the programmes can be made more attractive. The library will provide 10,000 copies of songs which are classified into singer, language, and rhythm. The Anchor can compile his selection by using this intelligent algorithm and the task can be accomplished within minutes.

News production can be improved by using crawler content optimisation engines that meet the requirements of the newsroom. Broadcasting audio content on the internet may be risky, and manual checking takes considerable time and effort. Broadcasters can utilise the audio-based media content intelligent system which uses NLP based speech recognition technology and fragmented speech comparison models of sensitive audios. These techniques can prevent pornographic and other undesirable content from being sent to the public.

Block chain technology can enable secure transmission over the internet as there are reported cases of malicious tampering with content and it is difficult to trace the source. Trusted audio-based sharing of block chain technology can enable the protection of digital audio files, traceability of the records of whole process operation and traceability of watermarks. There are issues, if the audio files are too large, resulting in the reduction of transmission efficiency and increased security risks. In these cases, the 'Sharding' algorithm can be used to extract digital fingerprint information and file slicing can be undertaken with the 'hash' function. Hence, the need for specialised personnel to monitor and

detect malicious content no longer exists, as the process can be automated. Content Distribution Network (CDN) is a system of servers or computers interconnected over the internet and placed close to users across the world. The servers contain duplicate content of the originating network to act as a back-up. A CDN is structured to reduce the distance between the server and end users for the purpose of efficient content delivery. For network providers, the two most important criteria are that they must meet Quality of Experience (QoE) and Quality of Service (QoS). The QoE is optimising the delivery of content ensuring a better customer experience while reducing the amount of network. The QoS is improving the performance by maximising the bandwidth and improving accessibility. Broadcasters need speed, and crash resistance by distributing the load to multiple servers instead of having all the traffic on the main servers, thus making it less likely to crash.

The digital transformation of the TV industry, driven by operating entire platforms from the cloud, is now taking place. Digital transformation has two phases and phase 1 is where online and broadcast are run as separate silos. Two different teams of personnel are needed to operate and maintain the two different sets of equipment. Technology has now matured, resulting in the transition to phase 2, where online and broadcast have converged and only a single team of personnel is necessary.

Digital Transformation will unlock six core benefits by transition to thinking digital first with cloud-based platforms. The first benefit is the reduction in operating expenses by converging workflows to a single TV platform. The second benefit is increased agility, which allows faster responses to an ever-changing market. The third benefit is the transformation of TV operations into a fully managed service where there is ability to do outsourcing in a secure way.

The fourth benefit is consistent cross platform functionality which reduces friction. Two separate technologies would achieve different results and consumers would be confused, causing misunderstandings. The fifth benefit is optimising the ROI on the biggest investment that is the content catalogue. As an example, to optimise revenues, the TV station may opt to release specific content online first and later broadcast on air. The sixth benefit is that the average revenue per unit (ARPU) can be increased by adopting innovative pricing model.

Pan Ming, 5G iMango Radio

Ts. Ahmad Shafiq Mirza Mansor (RTM)

Ts. Nurulhusna Mohamad Kasim (RTM)

A. Raza

CYBER SECURITY & MEDIA ON THE CLOUD

The moderator was **Peter Bruce**, Elevate Broadcast, with panellists comprising **Colin Prior**, ENENSYS and **Mohammad Paknahad**, IRIB R&D.

DTT equipment which occupied several racks a decade ago, has now, with technology improvements, become small enough to occupy a single rack. The latest trend is the transition to software-based architecture, which allows for better scalability and density. The same headend can provide hybrid delivery to address multiple devices. Full hybrid delivery has already been deployed in the USA with ATSC 3.0, using OTT streaming formats.

The next generation of DTT is virtualised and can be deployed on premises which use a dedicated server located at the headend or network operations centre. It is the most secure method but is very expensive. The second option is to use private cloud, which shares resources with internal and secured data transfers. The third option is public cloud, which has external and scalable infrastructure, but security aspects and QoS are difficult to manage.

End to end DVB-T2 reference architecture consisting of the T2 Gateway, T2 MI and SFN, Seamless switching and Monitoring are available as software-based solutions. Seamless switching is essential to avoid loss of transmitter synchronisation and resulting mute, with interruption to transmission. Autonomous switching between two streams is needed, together with seamless T2 MI switchover between two identical but non time synchronised transport streams. Site monitoring is needed to check transmitter stability and SFN time/frequency synchronisation. Monitoring at the receiver site is necessary to check the field reception.

System security is an overall concern which is not restricted to product development security processes & tools, but also to its environment. Complete system protection must consider many aspects, including software robustness, hypervisor robustness, hardware robustness, network robustness and physical security. Software products are exposed to threats which can originate from the public internet, operator's network, and users. The attack surface of a piece of software is the sum of the "attack vectors", where the "attacker" can try to enter data to or extract data from an environment. Keeping the attack surface as small as possible is a basic security measure. Thus, security aspects

must also be taken into account at all steps of the Software Development Life Cycle.

Broadcasting services via the Internet can use cryptographic technologies to protect data against cyber-attacks. Hypertext Transfer Protocol Secure (HTTPS) is an extension of the Hypertext Transfer Protocol (HTTP). It is used for secure communication over computer networks and is widely used on the Internet. The communication protocol is encrypted by Transport Layer Security (TLS) which uses cryptography algorithms. Quantum key distribution (QKD) is a secure communication method which implements a cryptographic protocol involving components of quantum mechanics. The main approaches to QKD are the prepare and measure protocols together with entanglement-based protocols. Post Quantum Cryptography, to be standardised by National Institute of Standards and Technology (NIST), which has initiated a process to evaluate and standardise quantum-resistant public-key cryptographic algorithms.

AI, BLOCKCHAIN AND BIG DATA APPLICATIONS IN MEDIA

The session was moderated by **Sunil, Prasar Bharati**, India and the panellists

were **Dr Mohieddin Moradi**, IRIB University; **Ben Vandenberghe**, Skyline Communications and **Negin Ayoughi**, IRIB R&D.

Standard Definition to High-Definition video format conversion may produce artefacts that can be annoying to viewers. Video aspect ratio correction techniques can be categorised into content independent method and content dependent method. In the content independent category, uniform stretching of the frame from 4:3 to 16:9 aspect ratio is done but this causes distortion. The second approach is to cut the margins, but content above and down the margins will be discarded, which is deemed unacceptable. The third approach is to add a black border to the left and right of the video frame or the top and bottom of the video frame to attain a 16:9 aspect ratio. In the content dependent category, dynamic windowing is conducted, taking into account the important details of the content.

A novel approach is to use an aspect changer to convert SD 480 x 720 to Wider SD 480 x 900. The Residual Channel Attention Network using Deep Convolutional Neural Network then coverts the wider SD to HD 1920 x

1080.High processing power is needed, and performance may be weak in high motion scenes. However, AI detects the saliency map and produces HD video with minimum distortion. This was found to be acceptable to test audiences, who could not differentiate between the original and the finalised video content.

AI can be leveraged to proactively manage media operations and ensure maximum availability and quality of service. Hardware infrastructure is changing to virtualisation and all IP networks are now the trend. Broadcasters are using cloud services and 5G networks may become a reality. These are enabling technologies with infinite options and challenges that are impossible to anticipate. An agile data driven media platform that handles the complexity of operation is needed. AI can play a key role in the agile platform as the amount of data is too vast for humans to handle. AI can deal with volatility, apparent stability and non- linear behaviour where the output cannot be taken for granted as the input to the system changes.

Big Data is a term used to describe a large amount of data in the networked, digitised, sensor laden, information driven, world. The growth of data is outpacing scientific and technological advances in data analytics. Big Data characteristics are classified in terms of Velocity, Veracity, Value, Variety and Volume. Velocity is the rapidly increasing speed at which new data is being created. Veracity is the truth or accuracy of data and information assets. Value is the insights that are generated are based on accurate data and lead to measurable improvements. Variety is the diversity and range of data types, including unstructured data, semi structured data and raw data. Lastly Volume is the size and amounts of big data. Applications in broadcast and media include processing

unstructured data which are audio, image, and video. Big Data is used in audience engagement and enhances broadcast production quality. Media data resources are mapped to the "V" characteristics of Big Data.

Key challenges exist in the areas of technology, policy, legacy, economy and sociocultural. Infrastructure is required in the big data value chain and there is a lack of big data security technologies as well as lack of specialised human resources. There is also a lack of policies to support big data development and no opportunities to improve services with big data analysis. Private data privacy through legitimate use of data is another problem. Another issue is the lack of transparency of the Open Data classification system to determine the right of access to them. Current business models with the subject of big data are inconsistent. Organisational development processes to exploit big data are lacking. There is lack of sufficient information about the amount, variety and sources of data production in the broadcast industry. In addition, there is insufficient familiarity of the public, private sectors with the benefits of the big data.

ADVANCES IN MEDIA DELIVERY – 5G AND BEYOND

The moderator was **Hamdhoon Rashad**, Asia-Pacific Broadcasting Union, with panellists comprising, **Dr Les Sabel**, S-Comm Technologies; **Peter Walop**, Convergence Consulting Company; **Nils Ahrens**, Rohde & Schwarz; **Prasanna D Meemaduma**, Kathrein Broadcast and **Oscar Hu**, Gates Air.

5G broadcast should not be compared with previous Mobile TV technology, including DVB-H and DVB-T2 Lite, which were not successful. There are several challenges to an emerging 5G business case.

The content provider needs to reduce distribution costs and reach wider audiences. The new system must be more reliable, flexible and make available an alternative to, or enhanced version of, the legacy cellular model. The Broadcast Network Operator (BNO) is facing changes in customer behaviour with Linear TV loosing popularity and smartphones are gaining importance. The Mobile Network Operator (MNO) has to handle the increase of mobile video consumption including live broadcast. The MNO has to explore new services and meet the demands of consumers who demand premium content anytime and anywhere. 5G offers efficient media delivery anywhere, anytime and to everybody. It utilises a broadcast/multicast approach, together with unicast or enhanced mobile broadband (eMBB). An overlay network is deployed with one-to-many concept together with the deployment of Supplementary Downlink (SDL) mixed mode or dedicated mode in existing cellular sites.

5G Broadcast enables linear television on mobile devices and an unlimited number of users can be reached simultaneously with the same Quality of Service (QoS). There is no consumption of any data volume of mobile subscription contracts when receiving linear TV or radio services.

An Emergency Warning System is available with a stand-alone 5G Broadcast network ensuring transmission of emergency warnings to TV, radio, and mobile devices.

A 5G Subcarrier Spacing (SCS Δf= 1.25KHz/ Cyclic Prefix=200µs) allows mobile TV reception up to 120 km/h whilst SCS (Δf= 2.5KHz/ Cyclic Prefix=100µs) allows mobility up to 250 km/h. A 5G SCS (Δf= 370Hz/ CP=300µs) allows Inter Site Distance of up to 100 km, providing for TV and big screen fixed

reception. Discussions are underway in ITU to consider EnTV/5G BC as a worldwide standard.

The current most efficient video codec is H.265/HEVC or High Efficiency Video Coding. However, this due to be replaced by H.266/VVC or Versatile Video Coding which is 40-50% more efficient than HEVC for UHD and 30% more efficient for HD and SD. The number of television services is limited by the amount of spectrum that is available. If HEVC is used, 14 fixed rooftop UHD services and 9 portable UHD services can be delivered in Europe. In the case of VVC, 28 fixed rooftop UHD services and 18 portable UHD services can be delivered.

5G Unicast delivery of FTA TV services is not feasible in the Low Frequency band or sub 1 GHz and is only marginally feasible in the Mid Frequency band (1-4 GHz,) if there is an increase in number of transmission sites by 4- 6 times. 5G Unicast delivery of FTA TV services is feasible in the High Frequency band (20-70 GHz) but will require the number of transmission sites to be increased over 20 times.

5G BC or 2nd generation DTTB will not be able to deliver all services in UHD resolution and thus TV broadcasters will need to provide a mix of SD, HD and UHD services. Film and TV shows provided at UHD resolution will be delivered via VOD and FTA TV will focus on news, sports and live events.

Traditionally, content carried over telecommunications networks has been considered a private matter in which operators are supposed to only carry traffic. However, FTA services are controlled by a Broadcasting Act which stipulates the number of national/regional services, editorial content requirements per service and advertising limits. FTA services are also regulated in terms of their quality, availability, distribution and must carry certain national programmes. These FTA network requirements are not common for MNOs, which is matter that needs to be examined.

MNOs having 5G BC will need to balance their traffic between unicast and broadcasting mode. However, for FTA services, which must be carried on a 24/7 basis, such capacity allocation to broadcasting mode would have to be permanent. Since FTA services should not be charged, MNO's SIM based solution in the smartphones must legally comply with the definition of 'free'. Delivery of UHD services to large screens over 5G unicast is not feasible. Hence, any FTA must-carry rule, will need to be delivered

over 5G BC which limits the MNO's traffic management options. FTA services delivered over 5G networks need extra safeguards for having these services available in time of national emergencies or disasters as traffic overloading occurs in times of national crisis.

BROADCASTING ON THE CLOUD – EVOLVING WORKFLOWS

The moderator was **Fintan Mc Kiernan**, IDEAL Systems SEA, with panellists comprising **Rahul Goyal**, Dalet; **Shad Hashmi**, Amazon Web Services and **Subodh Aggarwal**, TVU Networks.

Content supply chain challenges arise from multiple departments, agencies and contributors producing or acquiring content in different formats, lengths and locations. In addition, there is a lack of searchable metadata, standardisation or control of content management and downstream distribution workflows. There is limited visibility of content consumption and distribution and slow time to market and monetisation.

Remote Production creates audio-visual content through advanced

communications systems, avoiding moving part of the personnel and equipment. The basic premise is to maintain quality, and hence it is advisable to broadcast an event without technicians and comment on an event from an "off tube" booth. The studio equipment should be controlled from home and the broadcast monitored at home. Any repair of a breakdown must be at the technician's premises.

5G APPLICATIONS IN MEDIA PRODUCTION AND CONTRIBUTION

The session was moderated by **Dr Peter Siebert**, IEEE BTS and the panellists were **Zhang Shilei**, CGTN Digital; **Tatsuya Tobe**, LiveU and **Ronan Poullaouec**, Aviwest.

China is leading the world in 5G and moving towards 6G, which will be available for commercial use in 2030. China's 5G users have exceeded 355 million and are growing at the rate of 34 million per month. There are more than 200 carriers that have launched globally, reaching out to 700 million users. Metaverse went worldwide last year, becoming a fashionable and creative icon of progress. Technologies such as 5G, Blockchain, Virtual Reality (VR) and Augmented Reality (AR) have found their places in Metaverse. Even Facebook has rebranded by changing its name to Meta and will focus on a shared virtual environment. Metaverse will represent brand new opportunities and businesses and it is crucial that broadcasters are not left behind.

China Global Television Network (CGTN) has made groundbreaking technology applications that enable storytelling in different formats. With the support of 5G technology, CGTN has collaborated with several hardware companies to construct 5G live glasses, which will help frontline journalists deliver the news more quickly and conveniently. This technology will enhance the viewing experience of audience who watch videos from smartphones.

During the opening ceremony of the Beijing Winter Olympics, CGTN launched the Winter Games Express train which incorporates a live streaming studio powered by 5G technology. The live stream was stable, even while the train was moving at high speed, thus confirming 5G is robust and capable of mobile TV broadcast.

8K technology is growing gradually, with the display market projected to expand at a compound annual growth rate (CAGR) of 35% in 2022. The Asia Pacific region is the largest market with a share over 67%. NHK, the national broadcaster in Japan has a broadcast channel dedicated exclusively to 8K content and major sports events are transmitted in 8K. In order to increase 8K content, portable operation together with lower transmission cost is needed. NHK Technologies and several other companies have initiated a joint project to provide a solution for portable 8K live streaming over 5G/LTE mobile networks at a lower cost.

Remote production is where live content is captured from a distant location, while production is managed from a central control room. The benefits are less manpower and cost minimisation. Live event broadcasting, by using 5G, brings many benefit,s such as better video quality and higher resolution such as 4K or even 8K. If resolution is to be increased, higher frame rate is needed. High Dynamic Range (HDR) and wider colour gamut is another technical feature provided by 5G. Large sports events can be telecast with 8 -10 cameras as 5G can handle multi camera and immersive content. The fixed position cameras can be synchronised with mobile wireless cameras. With spectrum splicing and prioritisation, 5G can provide a dedicated network which is reliable and secure.

ADVANCES IN PRODUCTION TECHNOLOGIES AND APPLICATIONS

The moderator was **Masashi Kamei**, NHK, with panellists comprising **Yuichiro Asami**, NHK; **Mohammad Reza Hasanabadi**, IRIB R&D; **Dennis Breckenridge**, Elevate Broadcast, **Hazizul Jaya B Ab Rahim**, RTM and **Michael Lok**, Arista Networks.

There are several issues pertaining to 8K/4K UHD TV production. The viewfinder on the camera is too small (3.5in) and has a low resolution of 2K. Accurate focusing is not possible and a focus puller is needed but this is too expensive for a TV production. The focus puller operates by recognising objects and measuring the distance to them. However, an inexpensive solution can be found in the form of an AI object recognition system that includes depth sensor measurement. The AI contains a detail shift mode which changes the model from 40 object detection to 400 objects, enabling the details of the face such as the eyes to be shown clearly.

The MAG mode operates by dot-by-dot display centring on the subject of interest and also allows manual setting of distance to the subject. Briefly put, AI object detection and depth sensor measurement provides a single solution for comfortable focusing for camera personnel.

Lyra is a high-quality, low-bitrate speech codec that makes voice communication available even on the slow networks. In order to achieve this, the codec applies traditional techniques while leveraging advances in machine learning (ML) with models trained on thousands of hours of data to create a novel method for compressing and transmitting voice signals. The advantages are that it is a natural sounding generative model and can extract distinctive attributes from speech every 40 ms with low processing latency. The attributes are log mel spectrograms, a list of numbers representing the speech energy in different frequency bands, which are modelled after the human auditory response.

All recent cyber-attacks are large scale and most companies are unprepared. The sources of new network insecurity are from devices that are unmanaged, where breaches see no malware and the attack traffic is encrypted. AI can identify malicious intent by finding outlying

A. Raza — Les Sabel — Peter Siebert — Mohammad Nozari Pak

behaviours with characteristic artefacts, It can also identify behaviours with uncommon artefacts that deviate from behaviours with normal artefacts.

Awake Security has a new AI driven network detection and response model. The High-fidelity threat hunting component is based on adversarial modelling which is capable of uncovering complex threats with low false positives and negatives. The Situational Awareness component can discover, profile and track devices, users and applications using AI-based fingerprinting. The Autonomous Security component is an AI-based expert system to automate triage, investigation and response skills.

NEXTGEN TECHNOLOGY DEVELOPMENTS

The session was moderated by **Dr Les Sabel**, S-Comm Technologies and the panellists were **Aale Raza**, Whiteways Systems; **Dr Peter Siebert**, IEEE BTS and **Mohammad Nozari Pak**, IRIB R&D.

New video codecs are driving the industry, addressing the large bitrates needed for 4K and 8K transmission. The DVB Phase 1 Next Gen Video Codecs are VVC (Versatile Video Coding)/ H.266, AV1 (AOMedia Video 1) and AVS3 (Audio Video Coding Standard). VVC (Versatile Video Coding)/ H.266 was jointly developed by ITU and ISO with the focus on immersive applications. AV1 was developed by Alliance for Open Media (AOM, Google, Apple, and Netflix) and designed as license free codec. It is supported in many devices and included in Android 10+. AVS3 was developed in China and focuses on 8K, 4K, HD streaming and its objective is to have a

clear and reasonable license policy. It is mandatory for 8K broadcast in China and has been demonstrated in field trials and major events.

For broadband application, H.264 is still the most popular codec, whilst the most popular device for DTT broadcast is H.264/AVC and only six DTT systems use HEVC. AV1 is optimized for non-real time applications, where offline encoding is possible and in this case best performance is achieved by dual pass encoding.

Next Generation Video Coding solutions have been provided by MPEG, AOM and AVS. All codecs provide improved codec efficiency for 4K and 8K resolutions. More tests are necessary for comparison and meaningful comparison of video codes is difficult. The comparison is complicated by different reference softwares, configuration parameters, algorithms, picture type and GOP structures. Various license policies are supported but overall license situations are still unclear. The introduction of new codecs to the market is a slow process and may take many years.

Data is increasing worldwide and will reach 3 x 1024 by 2040. Data storage is limited by adequate silicon chips and magnetic tapes. Deoxyribonucleic acid (DNA) is an alternative because of its endurance and compaction. Companies are looking beyond silicon as the next generation data storage market is expected to be valued at $144.76 billion by 2024. DNA storage density is greater than current data storage media. DNA storage encodes binary data into synthetic strands, converting 1's and

0's into A (Adenine), C (Cytosine), G (Guanine) and T (Thymine) which are the four unique nucleotides that make up DNA.

Traditional data storage faces several issues as long-term usage is limited, with degradation over time. DNA is an extremely stable molecule with a half-life of over 500 years and will remain intact for hundreds of thousands of years. However, DNA synthesis is significantly limited, as it is reliant on organic chemistry which is only three decades old. Non biological DNA synthesis methods are inefficient, limiting limit the data file size that can be stored in DNA. Using DNA to store data is still in-laboratory science and there is a lack of dedicated technologies for DNA data storage. Biology engineering of the future will be the catalyst that drives down cost of DNA synthesis. It is expected to store 1 TB data per day and will initially be for 'cold' archival storage, which refers to data that is infrequently used.

CDN, IBB & OTT IMPLEMENTATION

The moderator was **Mardhiah Nasir**, IPSB Technology, with panellists comprising **Yin Loong Chao**, Akamai Technologies; **Fatemeh Fallahi**, IRIB and **Mika Kanerva**, Sofia Digital.

A new paradigm for combining client-side data and CDN logs is Common Media Client Data. There is a need for media players and CDNs to be able to exchange mutually beneficial information with one another. Players usually exchange messages every few seconds with each CDN, as they request playlists and media segments. Common Media Client Data (CMCD) is a defined set of
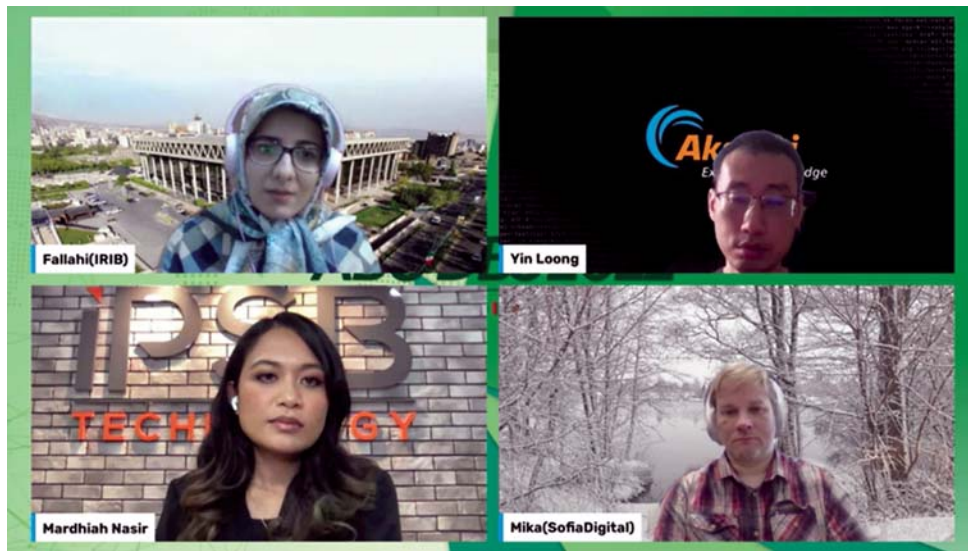
structured key pairs, communicating mutually beneficial media-related information from a player to a CDN. It is common because the same data structure can be used across all players and all CDNs. CMCD can obtain real time data on CDN delivery health, including buffer levels, buffer starvation, and bitrate. It can calculate the cost to deliver each asset, which is otherwise very difficult to determine.

HbbTV has several deployment challenges because of complexity of multiple standards and multiple browser versions. Market fragmentation exists, caused by devices on the market supporting different HbbTV specifications, and devices supporting the same version but not all the functionalities. Furthermore, there is a lack of debugger which makes it impossility to easily identify the cause of an issue. An HbbTV Test Suite together with Regime Specific Test Suite can ensure that receivers are interoperable.

HbbTV 2.0.4 is the next major update for the HbbTV specification and addresses current market requirements. One of the requirements is access to features in conformance with the European Accessibility Act which comes into effect in 2025. Other requirements are optional voice assistant integration and integration with DVB-I for linear OTT services.

HbbTV TA Phase 2 enables targeted advertising (TA) with dynamic substitution of ads in linear broadcast TV, with targeted ads delivered over broadband when the linear broadcast TV reaches the TV set over HDMI from a STB. Advertising revenue relies on reaching the maximum numbers of consumers. HbbTV TA phase 1 addressed consumers where linear broadcast TV reaches TV sets via cable, satellite or terrestrial and therefore broadcasters need to be able to reach this category of viewer.

Addressable TV advertising is the ability to show different ads to different

households while they are watching the same programme. Advertisers can move beyond large scale traditional TV ad buys, to focus on relevance and impact. Targeted ads are typically streamed over the IP during commercial breaks instead of the broadcasted ads. Advertisements can be subject to premium charges because the ads target a specific, more desirable, consumer. Targeting also enables smaller advertisers to purchase regional or targeted TV ads. The TA specification enables generic TV ads to be consistently replaced with targeted video ads.

IP TECHNOLOGIES AND REMOTE PRODUCTION

The session was moderated by **Kazim Pektas**, TRT-Turkey and the panellists were **Oriol Icart**, TVU Networks; **Peter MacAvock**, DVB and **Thomas Gunkel**, Skyline Communications.

DVB-I is an Internet centric media delivery system and is not a broadcast system based on IP. In the past, Broadcast and Broadband were operating in silos, but now DVB-I can help deliver DVB's broadcast-like experience on Broadband. DVB-Native IP is a converged media delivery system where IP based delivery is handled via broadcast, multicast, and unicast networks. DVB-I underpins the

converged ecosystem targeting the full range of devices. It breaks down the barriers between broadcast and broadband worlds. DVB-I can reach a wider audience and more devices. Common services can be deployed across devices without agreements with manufacturers. DVB-I offers higher interoperability and lower distribution costs due to optimised network usage.
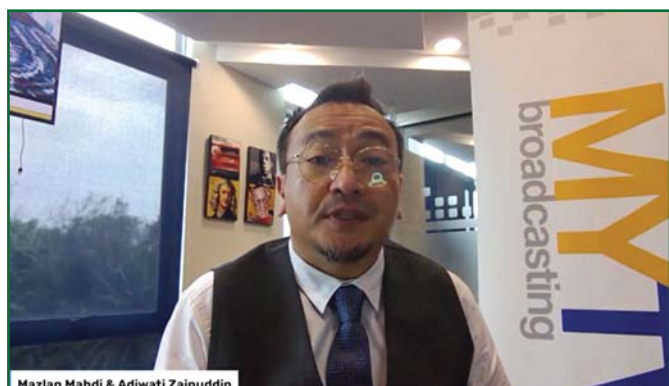
Remote Productions with Virtual Desks offers a personalised experience for each user at all times in all places. A virtual desk provides greater flexibility and more efficient use of physical and virtual resources. People resources can be shared by getting those who are needed. It is easier to adapt to new personnel location policies and new technology. A virtual desk is where a user logs in from anywhere and automatically gets a personalised control surface for the job they need to do at that point in time. It can have physical equipment attached and still be personalised. Every user has his own preconfigured personalised sets of desk setups, which can be different depending on the role the user will play, and whether the user works on the premises or remotely.

Virtual desks help users to manage complex and dynamic environments, allowing users to work from anywhere. They can integrate with collaboration tools and are an essential part of distributed operations. ▪

Peter MacAvock (DVB)

Thomas Gunkel - Skyline Communcations

Kazım PEKTAŞ

Oriol Icart - TVU Networks

DBS 2022 WORKSHOPS

Mr Mazlan Mahadi, *Chief Executive Officer, MYTV Broadcasting Sdn Bhd*

Adiwati Zainuddin, *Head of Content and Strategy, MYTV Broadcasting Sdn Bhd*

IMPORTANCE OF VIEWERSHIP AND KEY TECHNOLOGIES IN MYTV'S DEVELOPMENTS

MYTV is the Digital Terrestrial TV Service concessionaire for Malaysia and provides broadcasters a Free to Air platform utilising the 470-694 MHz RF spectrum. The FTA infrastructure is the largest in South East Asia operated by a single operator, with 95.3% terrestrial network coverage and 100% DTH Satellite coverage. Since 2017, all DTV sets sold in Malaysia are mandated to have an inbuilt DVB-T2 tuner, enabling the reception of myFreeview services. DTT coverage is expected to expand further with the addition of two sites at Guning Telapak Buruk, Negeri Sembilan and at Kangar, Perlis. 5.5 million people in these regions are expected to tune in to the new DTT service. MyFreeview has 18 DTV channels providing SD and HD services, 14 Digital Radio channels and Hybrid Broadband Broadcast TV (Hbb TV). New services expected to be launched include mobile TV, OTT services to smartphones and also pay TV.

With the pandemic restrictions being eased, the reach of most media have increased. The population in Malaysia, has access to a mix of traditional and digital media, enabling them to be kept informed, entertained and occupied. Advertisement expenditure dropped in 2020 by 15% compared with 2019 but returned to its pre pandemic level in 2021 with an increase of 18% on 2020. Digital spend edged out newspapers while

in-store adspend increased and overtook cinemas as they were closed for several months in 2021. Since the ASO, there has been a 125% increase of FTA channels and all in HD format.

MYTV is offering incentives for new broadcasters who sign up with it for at least 3 years by offering them a 3 month On Air trial without paying access fee. The lower access fee will ease the financial challenges for new broadcasters and allow them adequate time to garner revenue.

TV viewing is forecast to decline in 2023 as many households are shifting to mobile TV and spending time on streaming instead of watching linear TV. Thus advertisement spending is shifting towards digital screens in order to take advantage of consumer habits. There is a noticeable trend in the increase of Internet usage and streaming in line with smartphone ownership. Hence, MYTV is keen on viewer perception and viewership research will help it understand the factors that drive consumer demand. MYTV will conduct viewership engagement through high quality surveys to obtain information. In addition TV audiences would be measured by devices to gauge viewing behaviour. The way viewers watch content has changed and has affected the TV industry. MYTV is initiating DTT transmission on alternative internet platforms through Hbb TV and apps. Smart devices are used for communication and to seek streaming content. Installing MYTV apps on smart devices will increase viewership beyond DTV service. The convergence of interactive technology and linear TV through Hbb TV will bring a more enjoyable way to watch TV.

MOVING FORWARD WITH DAB+, STATUS AND NEW DEVELOPMENTS

It is vital that broadcasters continue to invest in the core platforms at the same time as developing internet capabilities. DAB and internet working together provide the foundation for a robust and total radio experience. The radio industry is transforming with DAB+ and streaming and a multiplatform model enables broadcasters to provide new services on live and demand. Broadcasters can develop new partnerships with governments and win the attention of and advertising dollars of a digitally focused advertisement industry. Australians use a variety of technologies to listen and although the share of listening by streaming has grown to 16% of the audience, listening via broadcast is still strong at 83%.

In Thailand a DAB+ trial commenced in April 2019 with 11 stations on air. Activities were delayed during
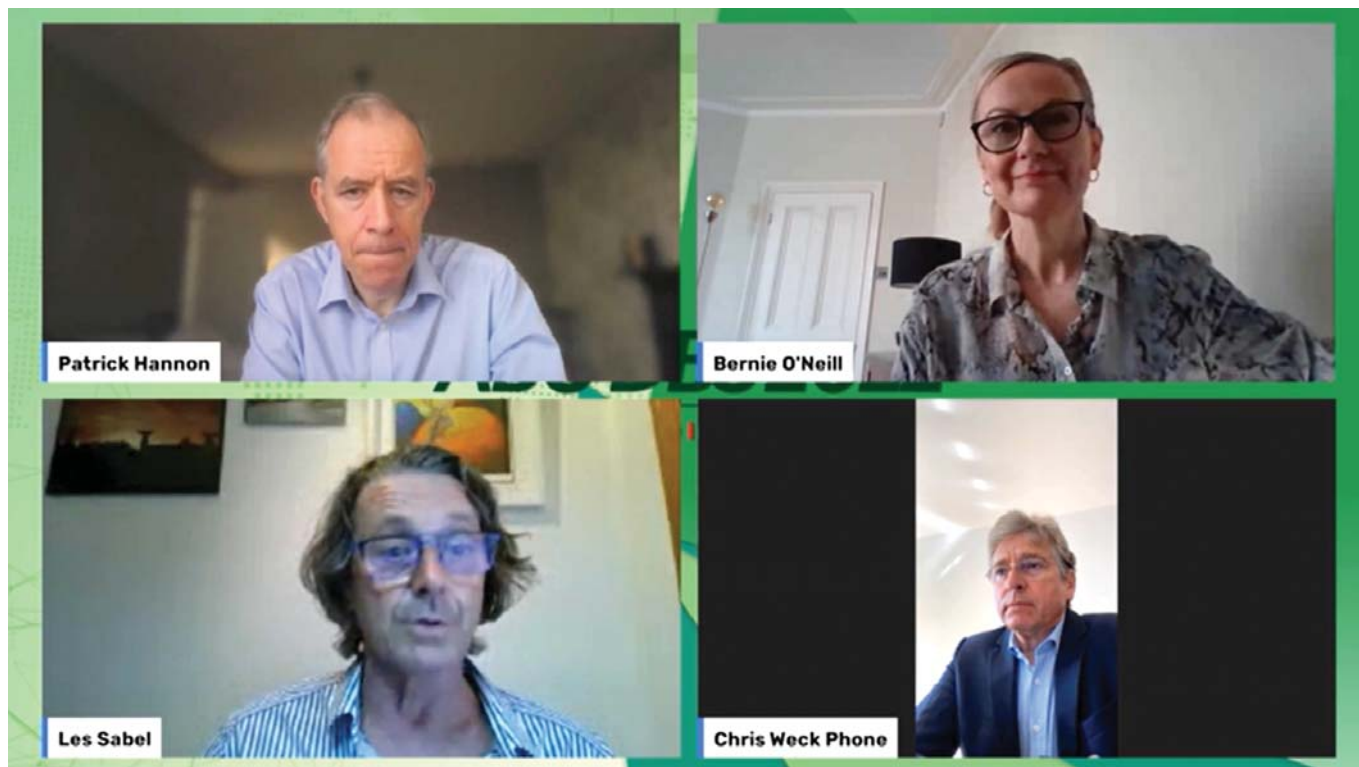
Moderator: **Les Sabel**, Chairman, WorldDAB Asia Pacific Technical Group
Speakers: **Patrick Hannon**, President, WorldDAB; **Joan Warner**, Vice President, WorldDAB and Chair, WorldDAB Asia Pacific Committee; **Chris Weck**, Former Head of the Technical and Infrastructure Department at Deutschlandradio; **Bernie O'Neill**, Project Director, WorldDAB.

the pandemic but are now moving forward. Trials have been extended in Bangkok and expanded to regional areas in the North, North East, Central and South of Thailand. In Vietnam, DAB trials are operating in Hanoi and Ho Chi Minh City whilst trials are still continuing in Indonesia. The WorldDAB APAC Technical Group was set up in order to assist the regional broadcast industry implement DAB+. This group provides participants the opportunity to discuss, learn and collaborate on all technical aspects of DAB+, with information particularly tailored to the Asia Pacific region.

DAB+ which is capable of Single Frequency Network (SFN) operation, broadcasts in Band III and can deliver 18 services per frequency. DAB+ is established as the core future platform for radio in Europe and Australia. Interest in DAB is growing worldwide with activities in South Africa, Tunisia and Middle East. DAB+ offers greater choice and seven times as many services compared to analogue FM. This allows broadcasters to cater to niche audiences, extend coverage of local services and add new language services. Digitisation offers reduction in distribution costs by 80% for both regional and metro sites. Thus, efficiency gains are from cost reduction and spectrum optimisation by the use of SFN.

17 million people, representing one third of the UK adult population, listen to services not available to them on analogue radio. The incremental reach has driven commercial revenues especially national advertisements. DAB also brings benefits to society as it is reliable in times of emergency and all DAB receivers are fitted with alarm features as standard.

Mobile networks cannot be relied on during an emergency as the transmission infrastructure may have been affected and traffic congestion from increased usage may cause problems.

The 5G standards and DAB+ have been compared for the purposes of radio broadcasting. The main aim of 5G is to have bidirectional unicast transmission using low power and low tower. A new option allows 5G to have a broadcast mode with high power and high tower which is a trade-off between data rate and area coverage. DAB+ is the optimised standard for radio transmission to portable and mobile receivers. It uses high power, high tower and broadcast is unidirectional. The transmission is robust, spectrum efficient and with SFN , a large area can be covered. However, 5G targets smartphone reception whilst DAB+ is transmitted is receivers with antenna. 5G allows for a variety of different system parameters and based on the same bandwidth and transmitter power, the same coverage area of DAB+ can be achieved. However, using high bandwidth for same transmitter power for radio makes full area coverage a very expensive option.

The use of a single standard for all on air transmissions is not practical as it would only meet a limited set of requirements and may result in a compromise for other applications. Digital standards are implemented in software (Software Defined Radio) making it possible for multiple standards on a single chip. The transmission costs and the performance of radio transmission systems are much more relevant than the use of a single standard.

*Moderator, **Ruxandra Obreja**, Chairman, DRM Consortium*
*Speakers: **Alexander Zink**, Vice Chair, DRM Consortium and Sr Business Development Manager, Fraunhofer II; **Yogendra Pal**, Honorary Chairman of the India Chapter, DRM Consortium*

The required field strength for radio reception using a smartphone is 20 dB higher than for antenna reception by DAB+. The received power depends on the physical size of the antenna and this indicates that 5G transmitter must use an extra 10 dB power. If the same power is to be maintained, the operating distance would be reduced from 30 km to 10 km. Transmitters would have to be increased nine times, making it unaffordable for broadcasters to achieve full area coverage for smartphones.

DIGITAL RADIO MONDIALE – INNOVATION AND EXTENSION

DRM is a global ITU standard for terrestrial Digital Radio enabling all coverage scenarios in the broadcast bands AM & FM/VHF. It can broadcast on a single AM/FM frequency and deliver up to 3 audio services and multimedia. Digital-only or simulcast operation is possible with AM or FM analogue signals. Stereo and 5.1 surround sound can be provided, with excellent audio quality. Area coverage is good and the robust signal can support SFN. An Emergency Warning System enables station switchover and audio and text information can be presented in the event of natural disasters.

Journaline is an advanced text service for digital radio, working on all classes of radio sets. It requires just a one-time setup with no editorial effort and brings Internet content to the radio.

Journaline enhances listener engagement, triggering listener interaction and opens up extra revenue sources.

DRM is the only digital standard for all the AM bands, offering FM like sound quality with large area coverage without fading or crackling. Some DRM MW band transmitters are capable of simulcasting both DRM and analogue broadcasts within 20 kHz bandwidth. DRM is also available for local coverage in all the VHF bands. Significant cost savings from between 50% to 90% can be realised, thus making DRM green and energy efficient.

DRM provides a transition path for established FM networks by fitting in the current FM plan. DRM transmissions can be placed in between existing FM stations without any interference with existing FM stations. Digital FM Radio brings additional revenue from Journaline media service that enables targeted ad placement & interactivity. Cost savings can be obtained from the distribution infrastructure as a single nationwide digital FM network can replace up to 3 analogue FM networks.

One of the world's largest digital radio deployments is in India, with 35 MW transmitters and three SW transmitters. More than 4.5 million cars have been provided with line-fit DRM in India since 2015. The chipsets support all standards and car manufacturers are not charging extra to consumers for the DRM receivers. DRM in the FM band is suitable for the Indian environment. Digitalisation can be implemented without disturbing existing analogue FM services.

Backward compatibility is available as existing DRM receivers can be easily firmware upgraded. Android phones can receive DRM in FM band by using off the

Speakers: **Sam Bogoch**, CEO, axle ai; **Neil Blake**, EMEA Business Development Manager, axle ai; **Mardhiah Nasir**, Vice President of Sales and Executive Director, IPSB; **Farikh Ikram**, Head of Technology, IPSB

shelf dongles and DRM MultimediaPlayer Radio App.

The transmission of DRM represents an extension of the standard used in MW bands with no additional IP royalties. The chipsets are designed based on local knowhow and made in India.

Pakistan has made it mandatory for car manufacturers and smartphone to be installed with DRM receivers. After one year of operation on simulcast mode, one hour daily will be allocated for transmission in pure digital mode. Once cheap digital receivers are available in the local market, the duration of pure digital transmissions will be gradually increased and the analogue transmission will be phased out.

South Africa is the first African country with a Digital Sound Broadcasting policy, paving the way for the migration to digital radio broadcasting including the use of DRM. South Africa is also the first country having all bands DRM standard and DAB.

The availability of multi-standard chipsets would further accelerate the adoption of digital radio broadcasting. Southern African Development Community (SADC), which includes South Africa, have mandated the complete DRM standard. Using a single technical standard is a solution for local, regional, national and international radio services.

CLOUD-BASED EDITING, SEARCH AND COLLABORATION
The boom in video use for broadcasters has been paralleled by swift migration to the cloud. Against this background axle.ai launched axledit, a revolutionary browser-based video editor with integrated collaboration, search, and publishing features. To address broadcasters' multiple workflow and change management challenges, axle.ai, alongside IPSB Technology, conducted a workshop entitled, "Bridging The Gap". This aimed at easing the transformation for broadcasters between on-premise workflows and cloud workflows and explaining their role in broadcast infrastructure.

This workshop gave ABU members the privilege of experiencing axledit first. axledit features collaboration, facilitating not only approval by producers and clients, but also simultaneous editing sessions with a shared view of the current timeline status. Playback is available with an AI function for efficient video content search, using various techniques, including face recognition, object recognition and speech transcription. axle ai and IPSB's partnership allows for this technology to reach a wider customer base, made possible because the software is cost effective and easily deployed.

The Workshop also addressed issues that broadcasters face in exporting their footage from axledit to software such as Adobe Premiere Pro, After Effects, Avid Media Composer and Apple Final Cut Pro. For infrastructure, axle ai runs both on premise and in the cloud, where customers have multiple options, including Linux for larger sized companies or Apple operating systems, which are sufficient as technology advances and devices gain more processing power through added cores.

Eliot Christian

*Speakers: **Eliot Christian**, Developer of Common Alerting Protocol (CAP); Pro Bono Consultant to IFRC, ITU, WMO and the U.S. Agency for International Development*

EARLY WARNING SYSTEMS (EWS) AND COMMON ALERTING PROTOCOL (CAP)

During emergencies broadcast TV and radio send warnings as "crawl text" and/or audio. Online media are using their own capabilities to help alerting authorities send warnings to the population using the Internet, at no charge. Governments have various public alerting systems which need to be patched together for effective warning.

Common Alerting Protocol (CAP) is a simple but general format for exchanging all-hazard emergency alerts and public warnings over all kinds of networks. Hazards can include weather, fires, earthquakes, volcanoes and landslides. The media can include television, radio, telephone and highway signs.

In a complex or evolving emergency, multiple trusted authorities often have separate responsibilities. The authorities include technical agencies and civic authorities with overlapping jurisdictions.

CAP helps ensure all trusted authorities communicate the key facts coherently. The official alerting authority can be a national meteorological, hydrological service, emergency management agency or any other organisation authorised to perform the function of alerting.

Aggregators and other intermediaries may lack direct knowledge needed to distinguish an authoritative source of alert messages. This lack becomes critical as alerting makes use of large public networks and the International Register of Alerting Authorities fills that knowledge gap. Each entry asserts a particular alerting source as authoritative, with its typical hazard types and its typical alerting area.

CAP is an universal adaptor for alerts, making it quicker and easier to Issue alerts. With CAP, posting a single message can trigger most alerting methods instead of sending multiple messages over the different platforms.

In a complex emergency, many types of information have to be assimilated from many sources and at a broad range of scales. Sharing of alert information is much easier with CAP. The public should not miss out on alerts, but they should only get only alerts intended for them. CAP data features enable custom messaging and automated translation for people with special needs or language barrier.

With CAP an alert can be disseminated in seconds, which is critical for sudden events such as earthquakes and tornados. CAP alerts are being used to reach landlines, cellular telephones radio and television sets. ■

ABU-IRIB Online Workshop on Interactive Media Services

7-9 February 2022

ABU Technology recently organised an online workshop jointly with the Islamic Republic of Iran Broadcasting (IRIB). The workshop on Interactive Media Services was a series of webinar sessions covering the latest media technologies such as AI applications in broadcast, image and video annotation, intelligent music and text generation, deep fake detection and IP solutions for broadcasters. Experts from IRIB shared their experiences and solutions developed in-house to address the challenges and requirements, and modern technologies needed to deliver broadcast and media services. The workshop sessions over the three days were attended by close to 300 participants representing 37 countries from Asia, Europe and Africa.

IRIB has an ICT centre which is the heart of its media IP-based technologies. This centre manages a vast range of services and projects through its four departments: IT Infrastructure, Cyberspace Security, Information Technology, Interactive Media Services. Key Projects supervised by the IT Infrastructure department include

design, execution and management of Imam Ali Data Centre, management of IRIB's IT infrastructure, private cloud, regional data centres, monitoring of IT services, dockerisation of micro services. Also, the management and supervision of website portals, data warehouse design for IRIB data, data lake for IRIB dataset, mail manager system, EPG system, IT help centre etc. The other department, Cyberspace Security, designs and prepares roadmap for cyberspace security technologies such as Security Operations Centre (SOC), Virtual Desktop Infrastructure (VDI), CERT etc. Likewise, all the tasks related to supporting interactive platforms such as OTT & HbbTV services, design & management of media assets are overseen by the Interactive Media Services department. It also involves itself in other tasks with regards to AI applications customised for IRIB, and value-added services such as AR/VR. The speaker, Dr Mohammad Asgari, Head of the ICT Centre, mentioned the pros and cons of these in-house IT solutions. While enhanced security, full control over project, unlimited post, delivery support, learn technology are
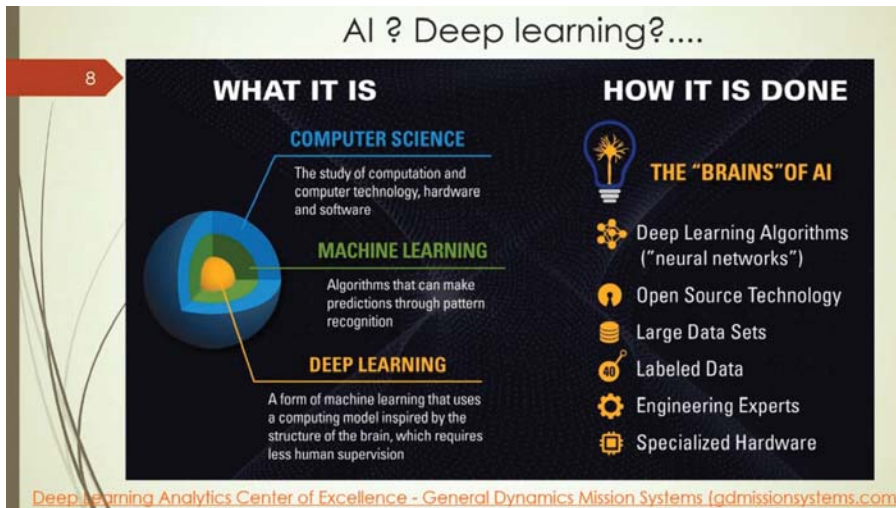
advantages, but slow launch, limited experience, recruitment & training costs, work interruption, dependency, maintenance costs, tools costs are negating those benefits.

The next topic was about AI applications in broadcast industry. The session speaker, Farshid Behjat Mohammadi, gave an overview of Artificial Intelligence, its application in broadcasting and some innovative applications. AI is deemed a good solution for today's challenges with regard to big data volume and verity requirements. AI is in fact a subset of the. engineering field for making intelligent machines and programmes using the machine learning and deep learning algorithms with neural networks, specialised hardware and large data sets. Machines learn as humans do in the same way – observing the world, comparing to its expectations, analysing differences, refining model etc.

High quantity and quality of Data with big processing infrastructure are regarded as the foundation of

AI ? Deep learning?....

Deep Learning Analytics Center of Excellence - General Dynamics Mission Systems (gdmissionsystems.com)

AI models. In broadcasting, AI finds applications in diverse areas such as innovative applications, social media analysis, HR optimisation, precision and validity as well. A high percentage of broadcast content lacks enough metadata, cannot be searched properly for production purposes, cannot be analysed properly, cannot be presented in social media and interactive applications besides the automated speech recognition (ASR) challenges in local broadcast applications. Production of new content from new faces are created by AI. AI accelerates new trends with art styles such as concept art generation for production, image generation from text, aiding complex motion capture scenarios, voice-based face motion capture, 3D object production for animation development.

The first day concluded with a presentation on Dataset Factory &

Automating Dataset Generation at IRIB. Ehsan Zalzar informed the audience that the growth of artificial intelligence infrastructure and the industrialisation of this branch of science in addition to skilled human resources altogether require investment in three sectors: computing power, algorithm and dataset. Data generation now takes place completely automatically or with reduced human intervention. A set of content including image, video, and audio that is labelled helps you to organise unstructured data collected from multiple sources to get the target outcome.

Dataset is designed more for machine processing than human readability. Common steps for dataset generation are gathering, preparing, choosing the right model, training the model and evaluating them. Creating an automatic data generation process not only saves

significant costs but also causes high speed in the implementation of artificial intelligence projects. Classification of required datasets is based on the type of application. Data collection means acquisition, labelling and improving existing data and a flow chart helps to define it properly. These data go through stages of self-learning and s crowdsourcing. There are several crowdsourcing data labelling platforms. Some use human intelligence as API. Image data augmentation goes through the process of extracting features that include object or face recognition for visual data, speech to text transcription, sound/speaker recognition leading to identifying objects, concepts and keywords.

Major challenges in collecting and generating datasets at IRIB are, the long time taken to generate datasets, high human resources costs, high cost of auditing and preparation, lack of quality data on many cases, specific data requirements for artificial intelligence projects etc. IRIB Archive has datasets of historic places, mystics and religious people, archives of songs and melodies. The architecture and process designed for the dataset factory at IRIB include a flow of researching and observing artificial intelligence models for labelling, evaluating the results of these models, operational evaluation of output results in laboratory, placing these models in the data generation line and receiving feedback from training results with generated datasets.
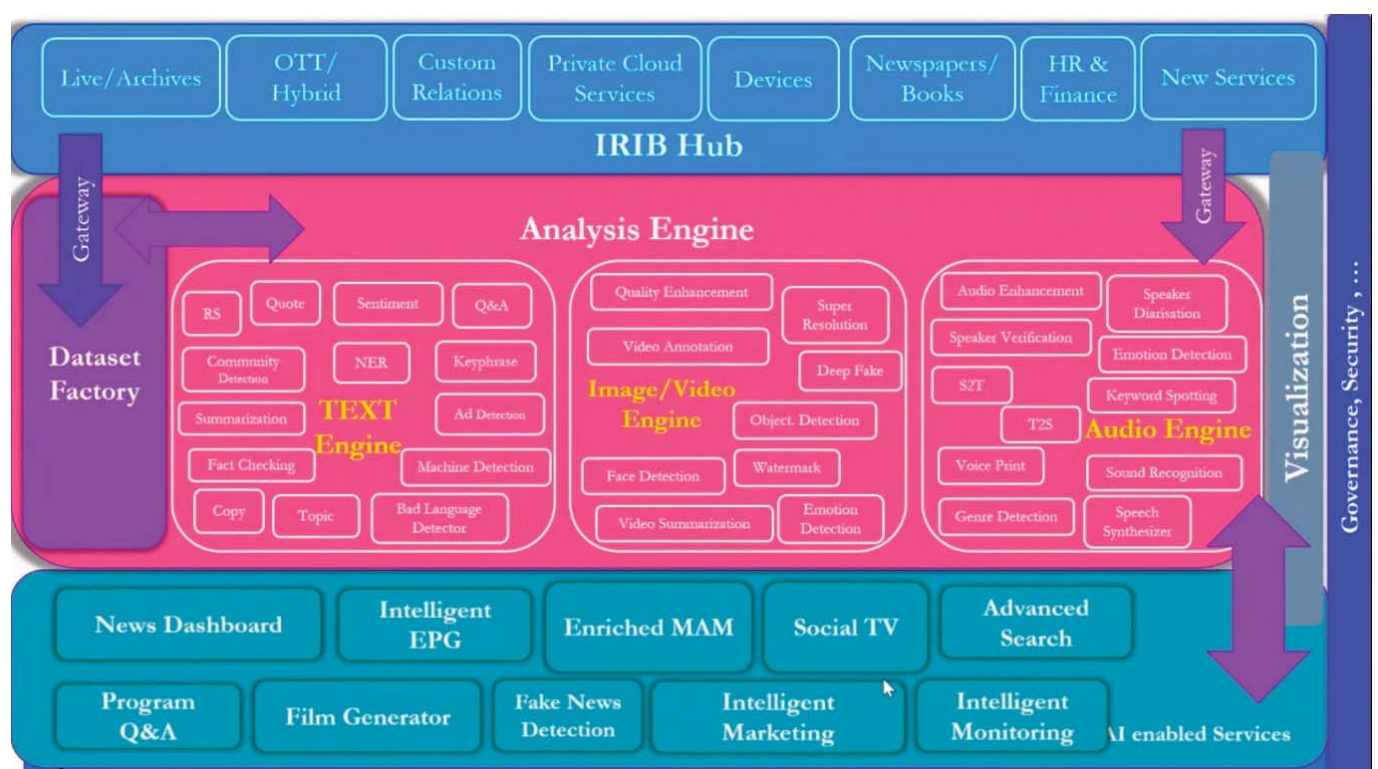
On the second day, the workshop continued with the topic of automatic image and video annotation. As the content goes through a media value chain from production & filming via processing & distribution to consumption, metadata creation and smarter techniques are employed for generating higher revenues. In the IRIB hub, datasets are extracted from live sources or the archive and processed by the multimedia analysis engine to deliver AI enabled services and visualisations to offer its services. These services are mainly Intelligent News Dashboard, where image and video annotation tools are employed. It assigns words to an image that describe the content of the image to generate summarisations, video search and retrieval, and creating datasets, relevant metadata, captions, keywords etc. Images are annotated and tagging is refined. Annotation and feature extraction passes through some steps such as training and testing images & related data with a model to predict relevant labels for each image. These images are described with respect to colour, texture, shape or segmentation.

Dr Shirin Ghanbari said that the MPEG-7 standard, integrated with deep learning AI technique is used to describe images and videos at the IRIB. Micro services are used to gain valuable information from the content that can be used in multiple services. Image annotation is mostly used for archival services and customised datasets for internal services will generally be added to its Dataset Factory.

A presentation on intelligent text generation looked at language models, transformers for language modelling, abstractive text summarisation and challenges therefrom. A language model is basically a machine learning model that can look at part of a sentence and predict the next word. Transformers are used for language modelling that are multi-layered encoder and decoder stack. Language modelling techniques- GPT2 and BERT- use neural network and self-attention methods for language generation. Some decoding methods like bean search or greedy search have been in use. Unlike in extractive summarisation, the abstractive summarisation employs a technique in which new sentences are generated using natural language processing. It employs a few techniques, such as structure based, semantic based, deep learning with neural networks, discourse and rhetoric structure based etc. Mahnaz Panahandeh cited an example that ParsBERT and Pre-trained mT5 models have been in use for Persian abstractive text summarisation. ParsBERT has the encoder only architecture of BERT whereasT5 is a unified framework for downstream NLP tasks.

Challenges remain in the field as is the need for quantitative measures, factual inconsistency. Since the introduction of the transformer architecture, various models have been developed for various natural language processing tasks. Since these models are so large, we need powerful GPUs. Appropriate datasets are needed in the fine-tuning stage. In Persian and many other low resource languages such a dataset is not available for some text generation tasks like movie script generation.

The next presentation, on Deep Fake Detection, featured deep fake generation techniques using artificial intelligence and machine learning. Deep fake is manipulating or generating visual and audio content and coined from the combination of two words, 'Deep' learning and 'Fake'. Deep fake was initially used in audio replication of famous people like actors, singers and politicians. Deep fake has been popular for several reasons. First, is believability, which means people believe in what they see and hear with their eyes and ears; Second, is accessibility of some popular applications for any devices; and the last is simplicity; that anybody can create deep fake. Common applications to create deep fakes are Deep fakes web, MachineTube, ZAO, Deep Art, Reface, Doublicat, AvengeThem etc. Deep fake usages in broadcasting could be as CGI and VFX technologies as used in movies; in education by helping an educator to deliver innovative lessons that are far more engaging, and in medical fields.

Many Deep fakes are created by auto encoder in a three-step procedure: extract the source face, create fake target face, and insert fake target face. Some deep fakes are created

❏ **What are the advantages of DeepFakes?**

Fast & Furious

❖ **Broadcasting:**

These days sophisticated CGI and VFX technologies are used in movies to generate synthetic media for telling a captivating story.

Star War movie
1994 → 2016

Interactive Media Services - ABU Event

by generative adversarial networks. For detecting deep fakes, one should pay attention to the face, cheeks & forehead, eyes and eyebrows, glasses, facial hair etc. As deep learning techniques are data hungry, large-scale dataset are required with real part and fake part in various quality i.e. VGA, HD. Deep fake images are then generated using different techniques and training different architectures with these datasets. The speaker Dr A Amirkhani briefed the participants on IRIB's works to detect deep fakes that used ensemble CNN method and customised user interface for collecting large-scale dataset, generating fake images, and annotating them.

The last topic of the second day was automatic music generation using an interactive evolutionary algorithm. Presenting the subject, Mohammad Mehdi Sehat introduced concepts and models of music generation like Markov models. And the music writing methods such as chromosome coding where melody is converted to numeric vector. Extract style is generally used for data collection to produce random melody and notes. Other steps include selection and composition of melodies, mutations in these melodies, jurisdiction function for ranking of melodies in the first phase, save the selected scores in the database, learning of such melodies using neural network training.

A typical music generation system at the IRIB had Matlab R2018b software, Intel Core I7 7700 HQ Processor employing hidden biLSTM neural network technique. Results were analysed from different phases of generation, using opinion assessment of 20 people. The observations found that, at most, a speed of 100 notes per minute was achieved with a home system, generated notes could be produced in any style & at any arbitrary length. The generated notes have high correlation with each other and successful transfers from note to note was possible. The challenges of the typical system were lack of attention to rhythm & volume and the whole rules of music and ignored special characters.

Fatemeh Fallahi introduced the first topic of the last day, 'Broadcasters in IP world: requirements, opportunities and challenges'. Latest video consumption stats and facts were highlighted, showing Video as the number one source of information for 66% of people. And a survey showed linear TV's progress to be stagnant However online TV. was growing fast. Over the top (OTT) TV and video revenue rocketed worldwide from 2010 to 2026. A growing percentage of digital media consumption takes place on, or is facilitated through, private media infrastructure. Global scale in content, usage, data and infrastructure gives global digital platforms a huge advantage over national or regional public broadcasters. Advertising revenue attracted by online platforms is such that online advertising accounted for 58% of all media advertising last year and will account for over 70% of worldwide ad revenue by 2025.

On another note, it was stressed that public service broadcasting still matters as it has three main responsibilities: informing, educating and entertaining. Vulnerable groups, as well as those who don't have access to the internet, are able to enjoy a broad range of information and entertainment, through public service broadcasting. We need to think public service media on a larger scale in order to rebalance the system. Also discussed was a timeline of How DVB is getting ready for future for building an IP-based future together with reference to DVB DASH, DVB-I, NATIVE IP etc. Another feature, Targeted Advertising (TA), makes the shift of ads to online possible, forcing traditional media to collaborate with industry players. TA allows broadcasters to prevent video ad budgets shifting away from television towards ad funded online platforms. The DVB-TA specifications are complemented by parallel work that has taken place in the HbbTV Association to address those commercial requirements from DVB. This relates to the interface between a broadcaster app and the TV set or set top box. In addition, HbbTV's evolution about its specification and services were highlighted in the session.

Then followed a session was delivered on a new topic- ITIL 4 and IT Service Management for Broadcasters. Information Technology Infrastructure Library (ITIL) is a framework of concepts and best practices for delivering IT services. It offers several benefits, such as increased user and customer satisfaction with IT services, improved

## Fascinating Video Consumption Stats and Facts

- Video is the number 1 source of information for 66% of people
- Over 500 million people watch Facebook videos every day
- More than 75% of all video views come from mobile devices
- The global video market was valued at $39.61 billion in 2018
- YouTubers upload 300 hours of video content to the platform every minute
- 93% of businesses gain new customers as a result of branded video content
- People spend an average of 6 hours and 48 minutes per week watching online videos
- 66% of people opt to skip online video ads

(Source: Statista)

Interactive Media Services - ABU Event

Medicine and Genome Sequencing
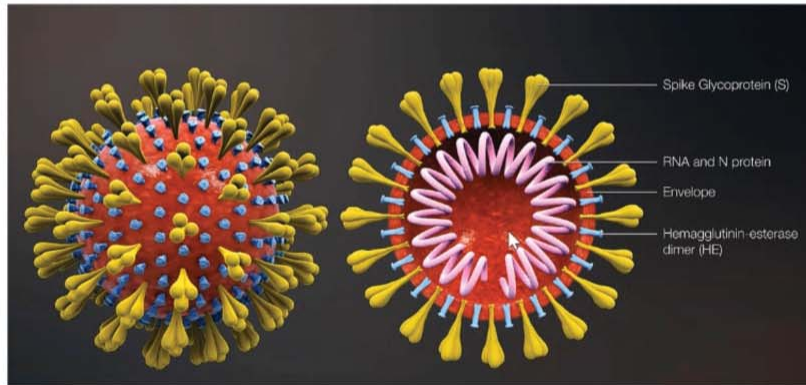
COVID-19 Virus

5. Pharmacology and Medicine (Mohammadali Eslamian, ABU – Feb. 9, 2022)

service availability, financial savings from reduced rework, improved time to market, improved decision making etc. ITIL 4 is a new scope and new generation of IT Service Management and is based on values, customers, consumers, stakeholders in the system value chain.

It is a four-dimensional model for service management with service offering containing 3 scopes: goods, access to resources, action with services. Broadcasters can exploit these 3 scopes of service offering in terms of TV programmes, processing and archiving resources, processing services and cloud services. Broadcasters can be both service providers and customers at the same time so as to produce and distribute Radio and TV programmes.

IT service management (ITSM) is simply how IT teams manage the end-to-end delivery of IT services to customers. This includes all the processes and activities to design, create, deliver, and support IT services. The core concept of ITSM is the belief that IT should be delivered as a service. The broadcast industry needs a framework to create value stream for an appropriate value chain for IT Services. Fereidoun Akhavanmalayeri stressed that the solution for this is ITSM and the framework is ITIL 4. The entire value chain of the broadcast industry including MAM, archives, production, and distribution depends on IT services.

Another interesting topic, about

Quantum Theory and its Applications, was presented by Dr M. Eslamian. He gave an overview of Quantum Mechanics and its applications in diverse fields, such as computing, cryptography, material science, medicine, Nano electronics, geology etc. Quantum theory is a branch of quantum mechanics with underlying applications in fundamental science, quantum computing, quantum communication and cryptography (Bitcoin), material science and computational chemistry, pharmacology and medicine, nano-electronics, geology and large-scale investigations.

A quantum system usually consists of atoms and molecules. A quantum computer is a machine that performs calculations based on the laws of quantum mechanics which is the behaviour of particles at the subatomic level. Albert Einstein theorised about quantum computation. A physical implementation data, in terms of a qubit, could use the two energy levels of an atom. Quantum theory finds applications in the field of nanotechnology representing smaller scale semiconductor devices up to 5 nm that consist of very few atoms. Examples of Nanotechnology devices could be spectroscopes, solar cells, sensors etc.

The last speaker of the workshop, Mikaeel Bahmani, spoke on Field Programmable Gate Array (FPGA) and its application in media. FPGAs are programmable or configurable

ICs in which the whole structure is programmable and configurable. They are used to implement any algorithm running on a processor (CPU, GPU, TPU, DSP etc). An FPGA provides significant cost advantages and are able to be dynamically reconfigured.

FPGAs find applications in broadcasting, audio visuals, and media such as in cameras for sensor interfacing, image processing and video output; in converters & KVM for providing low latency media connectivity; in AV over IP for supporting the transition to IP networks; in projection systems for cost-effective real-time video processing. Similarly, other units using FPGAs are routers & switchers for multi-channel real time video processing, in video processing cards, encoders & decoders, and audio systems.

Displays & signage systems for real time UHD video processing for LED walls, multi viewers and digital signage applications also use FPGAs in addition to servers & storage, and Transmitters & Modulators. Participants also heard about IRIB's FPGA based project about HD SDI audio/video multi-purpose system integrated in FPGA board. The project set up used for education purposes included some A/V equipment such as test pattern generator, video Splitter, frame synchroniser with multiple SMPTE formatted video inputs/outputs provision. ■

The DAB adoption process, Part 3: DAB+ requirements and allotment planning

by **Dr. Les Sabel**, Chair of the WorldDAB APAC Technical Group

ABSTRACT

In this article we discuss planning for the implementation of DAB+ systems within a country. It has three major steps: planning requirements determination, RF transmission planning and network implementation planning. In this article we look at service, coverage and spectrum requirements and allotment planning. The stakeholders that should be involved in this part of the planning process include broadcasters and regulators and in some countries network providers/operators.

PREREQUISITES

The prerequisites to starting the detailed planning process are:

- The broadcast industry has decided to move forward and implement DAB+
- The Regulator is agreeable to developing (or has developed) the licencing framework
- There is (or will be) VHF Band III spectrum available

The overall process to be undertaken is shown in the flowchart in **Figure 1**, which starts with the determination of the service requirements and concludes with the allotment plan being complete.
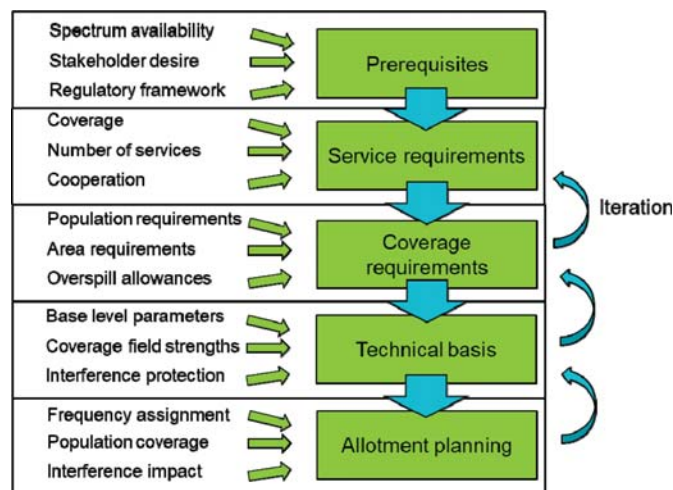
Figure 1: Requirements planning steps

The overall goal is to determine the allotment plan which will achieve the best long term benefits for the country. The process is generally iterative and requirements may need to be refined on an area basis, for example the number of services that can be delivered in a specific area will be impacted by the spectrum that is available, the coverage requirements and ultimately the technical basis which will define the coverage field strength targets and interference protection ratios.

In some cases the process flow will have existing constraints, such as when a number of transmission sites have already been constructed and are operational providing DAB+ services to the public. This was the case for the Allotment planning in Australia which was undertaken some years after the initial five main cities had established DAB+ transmission services.

SERVICE PLANNING

The starting point for DAB+ system planning is the number and types of services which already exist and the expectations for future new services. The development of DAB+ across Europe during the last 20 years has shown that where spectrum is available services will follow. The result is an expansion in the number of services that are available to the public, with typical increases in mature DAB+ countries being between 3 and 6 times the number of pre-DAB+ analogue services. It is therefore very important to factor into the planning requirements; not only the digitisation of existing services, but an allowance for new services in the future.

Services are planned by their coverage area or cell. National services are those provided consistently across an entire country, regional services cover a significant part of the country or multiple local or licence areas, and local services provide content only within a single local licence area. In many cases the number of national, regional and local services provided in an area have similar numbers, as shown in **Table 1** where the current service numbers are derived from www.wohnort.com. We see that each area has a significant number of services, all having more than 60, with London having the most, with 126. Overall the services by area type are reasonably balanced, however we see the UK examples showing relatively more national services due to the UK's small size and reasonably evenly distributed population, while Australia has relatively few national services due to its large size and population distribution being focused on urban centres.

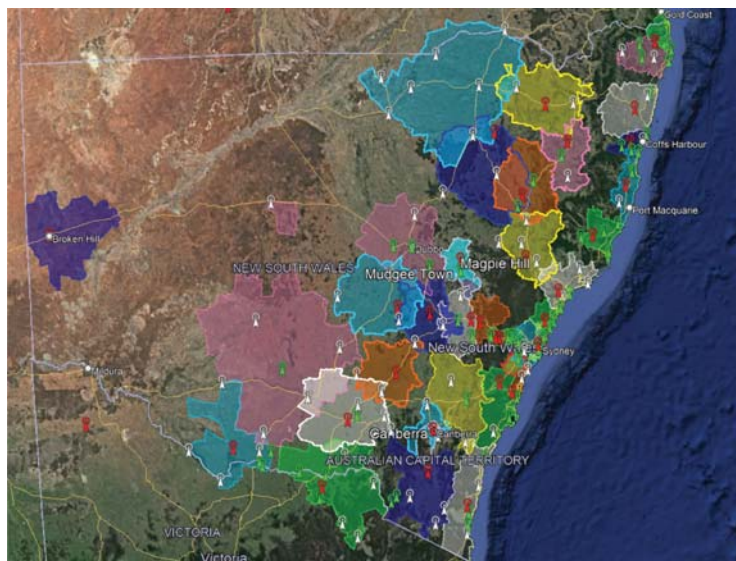| Location	Service types		
	National	**Regional**	**Local**
Sydney	11	30	33
London	57	47	22
Bristol	57	12	20*
Munich	27	22	20
Oslo	17	20	23

Table 1: Example number of services in an area

Services are also divided by the content and licence types, where we often see Public Service Broadcasters (PSB), Commercial Broadcasters and Community broadcasters.

COVERAGE AREAS

Coverage by area is generally separated into National, Regional and Local layers, where regional includes several local areas and national covers all regional areas and in many cases most of the country. Figure 2 shows an example of the 34 commercial licence areas in the state of New South Wales in Australia.

Community licence areas tend to be smaller and more focused on individual communities, however some may be the same as commercial licence areas particularly in the metro cities. PSB coverage areas are typically regional and encompass multiple commercial licence areas.

Figure 2: Commercial licence areas in the state of NSW in Australia

LICENCE TYPES
The main licence types used are public service, e.g. for the BBC or NRK, commercial e.g. stations from networks like Bauer and Global, and community. Each has its own allowances, restrictions and costs defined through legislation The number of services in an area will be a mixture of these basic types. The type of licence often also impacts the likelihood of additional DAB+ services. We find that PSBs typically increase their number of services by 2 to 3 times, commercial by 4 to 6 or more times and community generally less than 2 times. This demonstrates the value of DAB+ to commercial radio broadcasting. In some countries new services may be new market entrants after the introduction of DAB+ rather than the expansion of services from exiting radio networks.

COVERAGE REQUIREMENTS
Regulators will often require network providers to comply with coverage targets in terms of both the percentage of people who can receive DAB+ and the percentage of the country's area where DAB+ can be received at specific grades of service. This is to fulfil Universal Access and Service (UAS) obligations that ensure that no one is disadvantaged.

While coverage is critical, when planning DAB+ networks it is also critical to control interference, to ensure the correct grade of service can be delivered. Most countries have land or sea borders with other countrie, which will require cross border coordination to ensure that cross border interference is limited to acceptable levels.

SPECTRUM REQUIREMENTS
DAB+ operates in the VHF Band III spectrum band, which has traditionally been used for analogue television (ATV). The clearing of ATV from this band with its DTV replacement being made in the UHF bands IV and V allowed band III to be used for DAB+. Band III was extensively cleared and planned for DAB+ in Europe in the late 1990s and early 2000s, including the landmark ITU planning conference GE06.

The conversion of ATV to DTV is still underway in the Asia Pacific region with some countries having completed the conversion and ASO process and many still in progress. To start the DAB+ planning process Band III spectrum does not necessarily need to be available but a date for its availability is needed for industry

certainty. The availability date of spectrum, or even the start of the ASO process, provides target dates for system rollout. DAB+ can be established before ATV switch-off however due to high Protection Ratios (PRs) the DAB+ power may be reduced relative to planned ERP levels.

In some countries Band III spectrum will also be used for DTV, e.g. Australia and South Africa due to its ability to deliver signals over longer distances than at UHF for the same ERP. This requires spectrum sharing plans which will determine how many frequency blocks will be available for DAB+ across the country. As we have seen in both Australia and South Africa the provision of only two TV channels, or eight DAB frequency blocks, is the absolute minimum for most countries to ensure suitable range of regional services. When cross border coordination is required flexibility with their positioning will be necessary.

TECHNICAL BASIS
It is very important that the field strengths used for planning in different reception scenarios are suitable for the country planning DAB+. As shown in Figure 3 there are variations in the required minimum median field strength targets for different reception scenarios. This is due to variations in the 'base level parameters' used to calculate the coverage target field strengths. The physical equations are well known and example calculations are shown in the EBU document Tech 3391. Typical examples of variations are:

- Building entry loss: the amount of building entry loss is dependent on the type of building and the materials used for its construction. Radio frequency waves are attenuated more by steel reinforced concrete than timber, so areas which are dominated by high-rise buildings will need higher external field strengths to ensure suitable indoor reception than timber homes.
- Man Made Noise: The rise of electronic devices ensures that the background MMN level is higher in dense urban areas than in rural settings. This can become a sensitive issue when trying to receive DAB+ inside a building which has a significant quantity of electronic equipment, such as radio studios, PC dominated office environments and industrial sites.
- Vehicle antenna characteristics: Vehicle antennas have evolved from roof mounted whip antennas which have good omnidirectional gain characteristics, to in-glass antenna lines which have lower gain and often non-omnidirectional patterns. This has occurred due to the aesthetics of modern vehicles becoming more important than radio performance. Some countries have elected to redefine their vehicle antenna gain values to lower values to ensure that the required probability of reception in vehicles is achieved.

The establishment of the correct values for such parameters is essential to ensure that suitable reception probabilities can be achieved.

It is also important to select suitable values for the Protection Ratios (PRs) for both Co-Channel Interference (CCI) and Adjacent Channel Interference (ACI) however these are well understood and the values used quite universal (see EBU Tech 3391).

The issue of minimum service quality should also be considered. Most countries allow the market to decide what service characteristics are delivered though a listener acceptance approach where if the quality of a service is too poor then people will not listen to it and hence the viability of the service will be questionable. This is more the case for commercial broadcasters than PSBs who tend to prefer higher quality. Some countries however prefer to define the minimum service quality
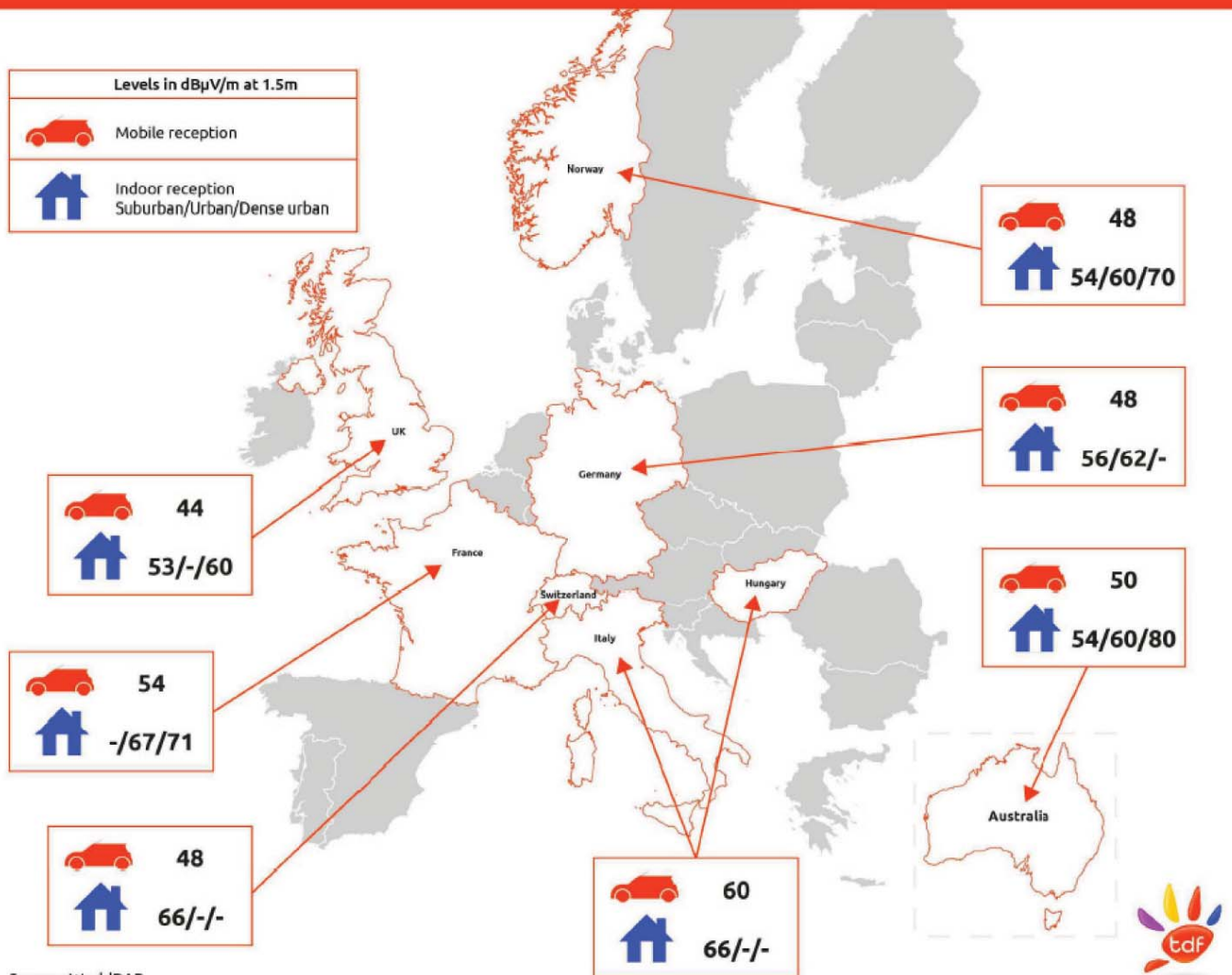
Figure 3: Example field strength targets, *Source: Jerome Hirigoyen, TDF*

through minimum service bit rates and Forward Error Correction (FEC) capability. Slovenia is an example where they have recently defined the minimum sub-channel delivery requirements of a bit rate of 48 kbps and FEC = EEP3A for stereo services. Services can be delivered at lower bit rates e.g. 32 kbps however the quality of the audio reproduction, particularly in new vehicles which tend to have excellent sound systems, can be quite poor for some types of content, especially when pure tones are delivered in music such as classical, jazz, folk and some modern styles.

ALLOTMENT PLANNING

ROLE OF THE REGULATOR
Regulators are responsible for a wide variety of technical and licencing aspects for radio system design and operation. Those responsibilities include the allocation of frequencies to broadcast areas, Allotment planning, and the allocation of frequencies to transmission apparatus, Assignment planning.

In ITU region 1, Europe, Africa and East and North Asia the ITU undertook a detailed planning exercise for the planning of VHF and UHF broadcasting in 2006, known as GE06. That conference resulted in the assignment of frequencies for broadcasting, largely throughout region 1, as well as a set of procedures to be used for variations, additions and cross border coordination. The Asia-Pacific is ITU region 3 which has no regional plan for broadcasting.
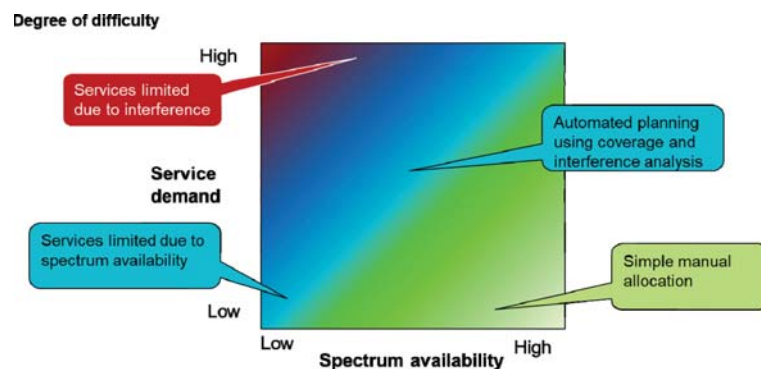

Figure 4: *Allotment planning complexity*

Currently planning for DAB+ in ITU region 3 is done on a country by country basis with cross border coordination being done directly between the regulators of the involved countries who need to agree the allotment planning process, which is typically based on ITU recommendations. The complexity of that process is dependent on the demand for services, which is usually driven by the population and regional radio areas of the countries, and the amount of Band III spectrum that is available. As Band III has been extensively used in the past for ATV, existing cross border channel agreements may still exist.

When spectrum is not limited and demand for services is low the allotment planning can often be done manually. If the demand is moderate and the amount of spectrum is reasonable, then it is often necessary to use automated allotment planning

methods based on agreed planning principles. If the demand for services is high but the available spectrum is low, interference issues will cause either the number of services and/or the served areas to be limited.

PLANNING PRINCIPLES

The approach to Allotment planning should be agreed between the major stakeholders usually the broadcasters and the Regulator. This ensures an agreed approach for all types of broadcaster. This is particularly important when spectrum is scarce and demand is high (Also see ITU-R BT.2140-12).

The Australian Digital Radio Planning Committee developed a set of planning principles, due to only 8 frequency blocks being available across Australia and the demand for two frequency blocks to be available in each commercial radio licence area. Those blocks were, one for the PSBs, and one for the commercial and community broadcasters. The Planning Principles can be summarised as:

- 1 – Overall planning approach
  - Plan for all areas in advance of any implementation to ensure balanced opportunities for first movers and late adopters.
- 2 – Proposed frequency allotment planning approach
  - Define and agree how much spectrum will be available for each broadcasting sector.
  - Initial main site transmission powers may need to be limited to ensure an overall solution.
- 3 – Licence area aggregation
  - When there are specific coverage licencing areas for commercial and community broadcasters it may be necessary to combine some to achieve a realistic overall plan.
- 4 – Transmitter site selection
  - Use existing sites where possible, this will minimise costs and interference between any DTV which may exist in VHF Band III.
- 5 – RF planning parameters
  - Select the planning parameters appropriate to your country in each class of reception.
  - This includes minimum coverage field strength to be protected, CCI and ACI PRs.
  - This may require some testing and experimentation especially with respect to vehicle antenna gains and patterns, in-building entry losses and man-made noise in cities.

The Planning Principles should result in a Balanced Allotment Process. We start with the general requirement of the maximum interference that one coverage area cell is allowed to cause into another cell in terms of people affected. The coverage requirements are generally considered secondary as they can be increased by adding low power transmitters later. The overall process is:

1. The stakeholder team define the baseline ERPs and antenna patterns (HRP/VRP) for each cell
   a. Use only one main transmitter site in a cell is provided with typical ERP of 5 to 10 kW, with some exceptions for remote and very dense areas. The ERP must be low enough to be able to obtain a solution for frequency allotments for all coverage areas.
   b. Typical antenna HRP is omnidirectional, VRP down tilt = 0°.
   c. Antenna locations are usually chosen from existing broadcast transmission sites with antenna tower height being the same as previous/existing ATV antennas.
   d. NOTE at this stage we are not interested in the transmitter systems themselves, only the radiated power and pattern.
2. For a set of assigned powers calculate the field strength coverage for all areas using the same frequency
   a. Typically use the centre frequency of the available frequency band
3. Determine the CCI between all sites
   a. The initial planning is done for CCI, ACI is considered as a

secondary issue.
   b. CCI is generally assessed as the number of people in the affected cell who will lose reception due to interference.
4. Assign candidate allotment frequencies to each area
   a. Typically using a cellular approach where co-channel assignments have maximum distance between them. This can be done manually or using an automated approach.
5. If the interfered population in each cell is less than the target, then finish, else reduce/adjust the ERP and HRP of sites which cause the most interference.
   a. Higher elevation sites will radiate further due to larger areas of Line of Sight coverage.
   b. Problematic main sites may need to be significantly reduced in power and have low power repeaters added to ensure suitable area coverage.
   c. Repeat from step 2 where coverage and interference is reassessed for sites with changed ERP/HRP.
   d. If the initial interference is too high it may be necessary to reduce most/all site ERPs.

This process can be quite complex when there are a lot of individual coverage area cells and will often mean that it is not feasible to manually select the set of frequency assignments which meets the local interference limits. The complexity of allotment planning can be reduced by using a few rules:

- Limit the number of cells in the area to be planned to limit the number of possible combinations.
- Use large pixel sizes when running coverage and interference simulations, e.g. 100 m x 100m or larger.
  - The impact on the initial analysis of clutter will be small
  - Higher resolution analysis can be done for specific cases when the allotment plan is starting to converge to an overall solution, i.e. all cells have interference of less than the target when using a selected set of Allotment Frequencies.
- Some cells may have preassigned frequencies, e.g. cells which have already been planned/implemented or in a set of adjacent cells whether in country or across borders.
- Do not allocate the same frequency in adjacent blocks, have at least one intervening cell between co-channelled cells.

Once a set of allotments has been successful planned the coverage in each cell can be assessed and adjusted through the addition of low power repeater sites to ensure that over time adherence to population and area coverage targets can be met.

CONCLUSION

The development of the requirements for the deployment of a new radio system can be a complicated process. It is essential that all stakeholders are engaged in the process and that all have a flexible position to ensure an overall positive result.

In our next article we will cover the details of the coverage and interference analysis aspects that are used in both allotment planning and any subsequent adjustments to the initial transmission parameters.

AUTHOR

Dr Les Sabel, Chair, WorldDAB Asia Pacific Technical Group, and S-Comm Technologies WorldDAB.

Les has over 30 years of experience in communications systems, including broadcast digital radio (DAB/DAB+ and DRM), mobile communications, wireless broadband and satellite communications. Les founded S-Comm Technologies Pty. Ltd. in 2008 to work with the radio industry on DAB+ digital radio. S-Comm provides independent engineering consultancy to WorldDAB, the ITU and broadcasters, regulators, network operators and equipment suppliers in Australia, South East Asia and around the globe. ■

5G iMango Radio - Create a Radio Programme in 5 Minutes 14 December 2021

ABUTechnologyWebinar The Speaker

5G iMango Radio – Create a radio program in 5 minutes

Mr Pan Ming
Director of Content Department, 5G iMango Radio, China

Hunan Broadcasting Group established China's first AI aided New Broadcasting Technology laboratory in 2017 and developed an artificial intelligence (AI) broadcasting system called the 5G iMango Radio system. The integration of 5G, AI, SaaS, Big Data and Block Chain components in the Radio system makes it a smart broadcasting system. In China, 513 radio stations were using 5G iMango Radio in 27 provinces as of December 2021. It offers the capability for a radio station to be built in just 5 minutes.

Core functionalities of the system allows broadcasting without presenters, producing news without reporters or editors and achieving radio broadcasting with just one person. It brings integration of AI Broadcasting Technology, Copyright management, iMango Smart
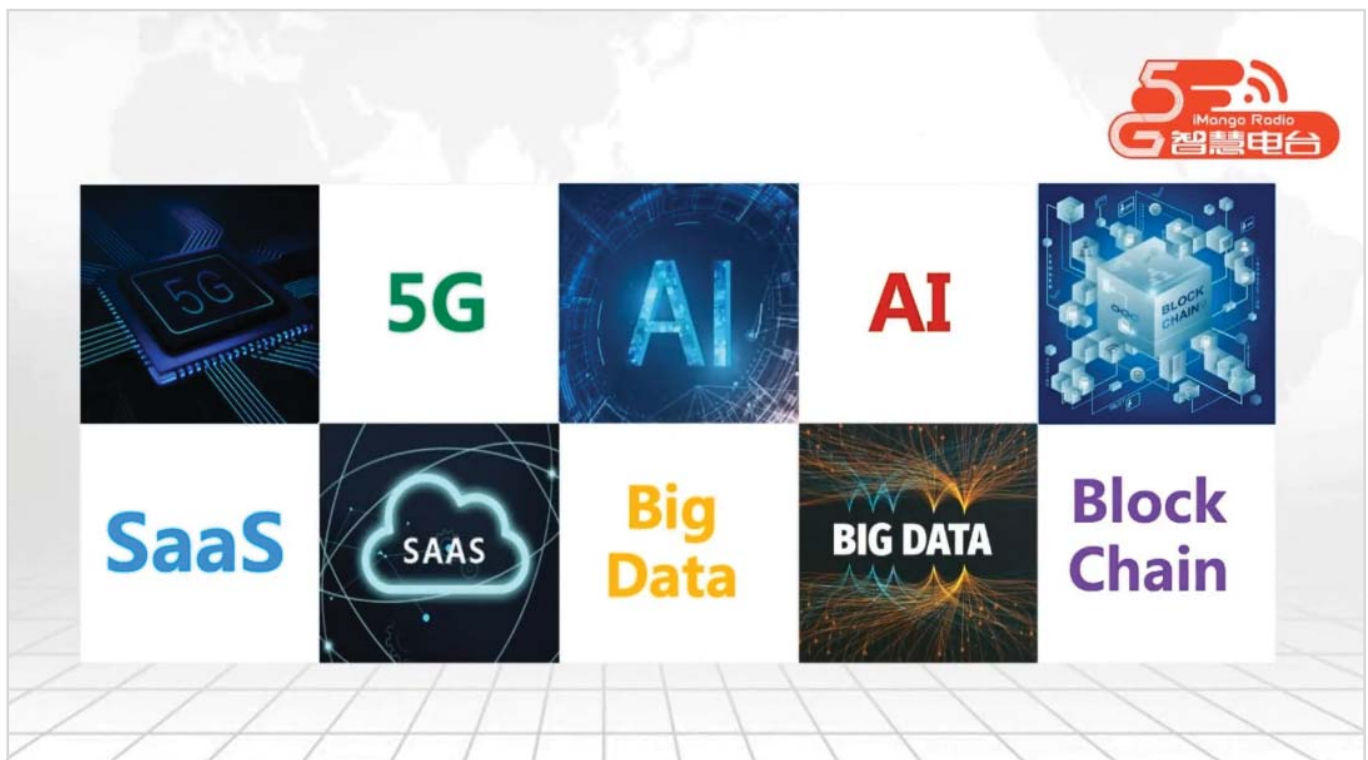
Broadcasting System all in one system. NLP voice editing and the voice synthesis technologies that are used in production systems. The different programmes aired using the application are traffic information, music, Local news, Real time traffic information, Real time weather. Five minutes Radio set-up is possible with auto capturing, auto audio generation and auto scheduling.

Five Major Highlights of 5G iMango Radio System are: Firstly: Safety, with A block chain broadcast system; Secondly Intelligence with Broadcast & Monitor automatically with Cloud distribution; Thirdly faster production capability with AI support edit, review, generate voice, & broadcast.

Fourthly It exploits green technology for all customers can use all the services of 5G iMango, Radio without deploying an exclusive server, allowing sustainable development

of broadcasting. And lastly less investment is required, owing to no extra hardware or manpower being needed. It doesn't replace anyone but only upgrades the regular operations with backward compatibility.

Technological revolution breaks limitations and AI technology is changing our lives in every possible area. Hunan Broadcasting system has an optimistic vision of extending its coverage to 1000 radio stations in 3 years and a long-term goal of creating a radio union in 1,000 cities and 1,000 radio channels.

The speaker, **Mr Pan Ming**, Director of Content development at 5G iMango Radio, walked through a video clip introducing the features and benefits of 5G iMango radio. Around 58 participants, representing about 35 organisations from 22 countries attended the Webinar session on Member Innovations.

Full IP UHD Remote Production Full-scenario Solution 11 January 2022

ABUTechnologyWebinar The Speaker

Full IP UHD remote production: A Full-scenario solution

Xie Qin is Senior Engineer and Senior Export of the Shanghai Media Tech (SMT). He led the team to complete a series of domestic and international large-scale sports broadcasting tasks, including the 2018 PyeongChang Winter Olympic Games, the 2021 Tokyo Olympic Games, etc. and was the first Chinese expert to lead the domestic broadcasting system to complete the technical services of Olympic broadcasting overseas.
During his career, he participated in and completed many scientific and technological innovation award projects.

Xie Qin
Senior Engineer,
Shanghai Media
Tech, China

Events globally have gradually explored full 4K production, including the Olympic Games, World Cup, national Games and so on. Shanghai Media Tech (SMT) took the lead in building the first 4x3G SDI full 4K broadcast OB Vans in China in 2015 and participated in 4K broadcast production in different Games. The roadmap started with adopting a 4K IP System in 2017, first remote production in 2018, Remote Production at Military Games in 2019 and Esport World Championship Remote Production in 2022.

SMT's Media Hub architecture connects the venue set-up to the remote production and broadcast centre. The aggregated signal from broadcast compound at the venue are transported to the remote centre via 5G and redundant Fiber Optic circuits. In The Remote centre chain, signal flows from contribution centre to the transmission & dispatching centre. Additional rights holding broadcaster facilities and commentary switching centre are connected via appropriate connections.

The transmission centre deploys different connectivity
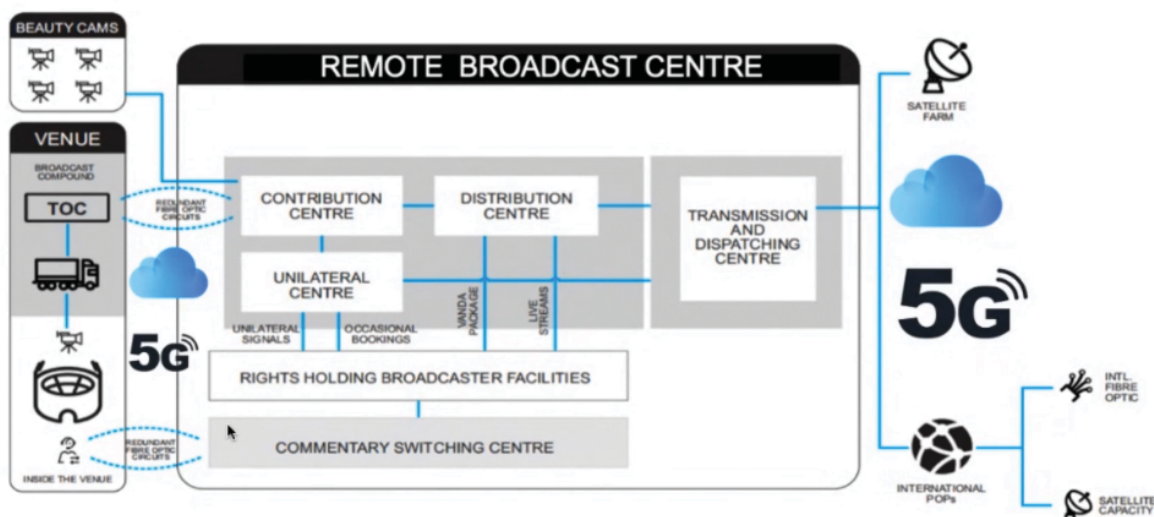
via a satellite farm, 5G, Cloud and international POPs to link to national & international destinations. Technical routes within the city are uncompressed, via Dark Fibre, OTN, 5G or SMPTE ST2110/2022 connections. While the connections across the country are compressed 10G lines, those across the continent are deep compressed signals of 1G, SD-WAN, H265 formats.

SMT's future rollout explores a modern system, utilising cloud and virtualisation technologies with multiple I/O connections across diverse equipment. The equipment includes at least an audio mixer, K-Frame, multiviewer, flow monitor, playout, test signal, clip records, and intercom switching. Beiing 2022 makes use of cloud based Visual OB van on multiple sites with additional e-sports capability.

The Visual OB signal is HD 1080p50 SDR format. **Xie Qin**, the Team Leader at Shanghai Media Tech for the Tokyo Olympic Games, delivered this presentation. The session attracted over 90 participants from 32 countries.

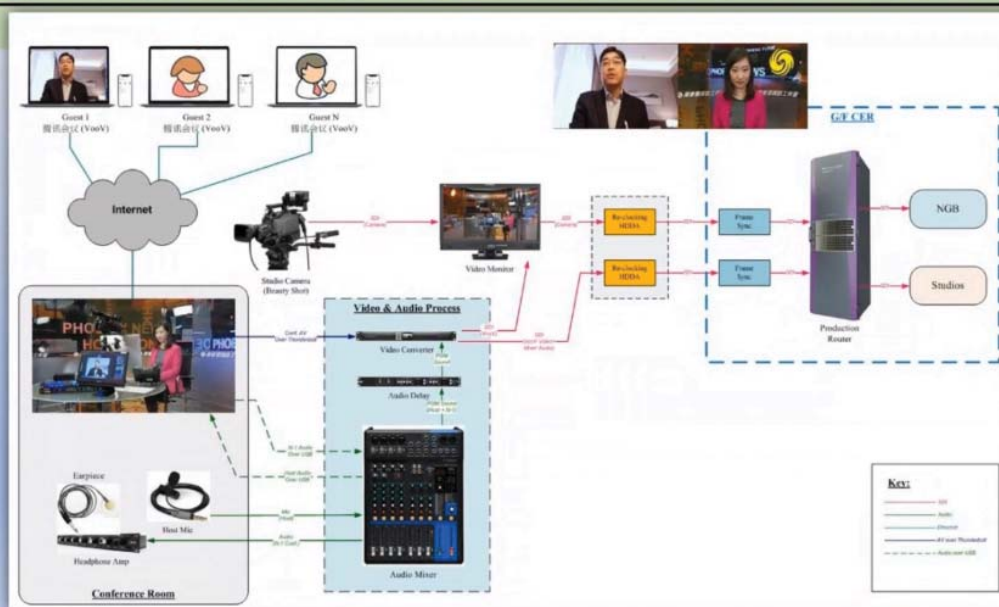# Cloud Interview for News Production at Phoenix TV 19 January 2022

Cloud Interview for News Production – Phoenix TV

At Phoenix TV, interviews with the guests & experts became a challenge during the pandemic. Traditionally, interviews would take place on-site. Thanks to IT technology, internet and video conferencing, the problem has been solved and they are now able to do interviews remotely. With these solutions, quick response and flexibility are achieved.

CPPCC and NPC, two major political conference events in China every year, are spotlight events for all Chinese news media. Several popular conference software platforms are available in the market. e.g., Zoom, VooV and Microsoft Teams. Phoenix TV adopted VooV for news interviews during CPPCC and NPC in 2021. A small conference room is setup in-premise for the interview. The Journalist can sit in the conference room and host the interview with the remote guests, and can handle the whole process alone. The interview arrangement can be very flexible and may take place any time, whenever there is a need. The interview signal is sent for live transmission or for future recording and post production. The embedded VooV video and programme sound is fed to in-house production router for studio production. In the video conferencing app, the host and the guest camera source is selected as the

individual video only, or included in a multi-windows view for all participants.

Some considerations have to be taken into account for the implementation, such as signal quality, audio delay and frame sync. With WIFI or mobile 4G/5G internet connection, participants or guests can connect to the meeting on different OS platforms and devices anytime anywhere. This has helped to make recordings a convenience and easy operation and facilitates quick and successful production of news interview instances. Some problems encountered at Phoenix TV during the production were, unstable internet speed at times, lip-sync issues, and frame sync issues. Earlier, Phoenix TV carried testing with different setup and monitored performances of each setup before making a final selection. Thus, Cloud Interview has proved to be a useful and cost-effective tool for news programme interviews during the pandemic.

This session in the series was presented by **Edward Ng**, Senior Systems Engineer from Phoenix TV, Hong Kong, and it was attended by about 65 participants from 25 countries in Asia-Pacific and elsewhere.

Indigenous development of News Room Automation with Cloud-based News Data Management 25 January 2022

This session was mainly focused on News Data Management System (NDMS) and News Room Automation systems with cloud applications. The speakers, employed at Doordarshan Centres - **TS Ramakrishna**, **K Balaji**, **R Arul** and **S Gurumanickam** - delivered a real time demonstration of these application softwares and their functionalities along, with hardware/software requirements. Over 90 participants attended the two-hour webinar.

Prasar Bharati is India's public broadcaster and comprises the Doordarshan (DD) Television Network and All India Radio (AIR). DD News has 31 functional regional news units which are broadcasting over 157 news bulletins in 22 languages per day. AIR News has 46 functional Regional News Units which are broadcasting over 697 news bulletins in 92 dialects per day. The reason for developing Indigenous - in house applications in Prasar

ACTIVITY UPDATE

ABUTechnologyWebinar

The Speakers
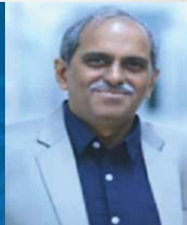
TS Ramakrishna Deputy Director General (E), DDK Hyderabad, India	**K Balaji** Assistant Director(E) DDK Chennai India	**R Arul** Assistant Engineer(E) DDK Chennai India	**S Gurumanickam** Assistant Director(E) DDK Chennai India

Indigenous development of News Room Automation with Cloud base News Data Management

Bharati was due to limitations, such as changes in operational workflow, support issues, license Fees, and customisation and migration issues with other software and applications.

NDMS is a cloud application, facilitating the collection of news for AIR & DD. It facilitates collection of video, audio, image, text from stringers, reporters and RNUs, including citizens, like any news agency. It is a complete web-based application with no application software required on client side. User/clients can access and operate from any web browser. It works across all operating systems and is device independent. This software consists of modules like User Module for user registration, approval and login; Task Module for task assignment & monitoring; Upload Module for content upload irrespective of size, file format, device. Other modules, such as Proxy, Download, Billing & Payment, Analytics, Edit, Feedback, and Help are integrated too.

Another major topic of the session was the News Room Automation system. Indigenous NRCS was born to overcome limitations and difficulties in the old systems. Their technical staff received training on ASP.NET, chosen for the front-end. Since the team had experience on MySQL, it was decided to use this and other open source applications to develop the automation system. Different Components of News Automation software were News Clip Edit, Video Playback, Graphics Overlay, Teleprompter, Script Print Out etc. The NRCS meant for managing the entire news process from writing down the script to prompter presentation

level has been completely integrated in the software. It has features of uses/privileges etc. News Editor, News writer, News Producer and News Video Editor.

The modules of News Automation are NRCS Software, Prompter Software, News Playback Software, Graphics Play out Software, Data base and IIS server with redundancy. In News ID or Run Order Manager, one can add or delete or ordering of the News ID. Script Archive and Search facilitates to archive the script at the end of the bulletin for future reference. One can search the archived scripts using any word, date or bulletin etc. Slug and Script Editor are used for making new or modifying or deleting slugs for every bulletin. Script Editor is used for scripting detailed stories on each slug. Word count and read time is instantaneously displayed. A printing facility with word count and last update time is available with the editor.

A Video Tagging feature allows an item to be tagged immediately, once the visuals are edited, so that all in the news desk can preview the visuals. Graphics Overlay on Visuals and News Scroll are other features of the editor. Teleprompter allows the capability of feeding prompts as a SDI video signal, the present set of monitors and prompting paraphernalia could be easily utilised without modification. The application is always kept in sync with the main application and database such that any change in data is immediately transferred to the prompter. A separate video playback application was developed in VB.NET which connects to the main database. The video editors edit and associate a particular video with a story.
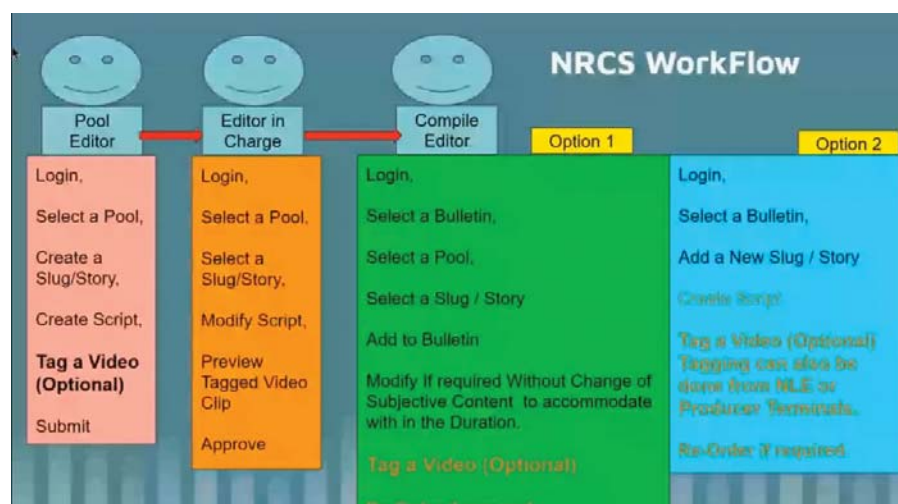
The webinar series on member innovations provides member broadcasters with a platform to share their stories, case studies and advancements in broadcasting. In the webinars, members also shared their experiences in customising existing technologies and in some cases how they developed creative solutions in-house to meet their specific requirements. Experts from different broadcasters shared innovations and creative solutions developed and implemented by them during these four episodes of the series. ■

A22 Global Coordination Conference 17 January-4 February 2022, Online

The A22 Global Shortwave Coordination Conference was held online from 17 January to 4 February 2022. Held twice a year, the conference provides an important forum to resolve, or minimise, instances of mutual interference among shortwave transmissions, for the Summer (A) and Winter (B) seasons.

The Opening Plenary meeting was conducted on the 17th of January and the Final Plenary meeting took place on the 3rd of February 2022, and both were conducted virtually. At the final plenary, there were two presentations; one on 'ITU-R Article 12 process and planning procedures', by representative of the ITU, and the other on 'How Radio Miami International Monitors its Signals', presented by the HFCC Chairman. The Plenary meetings were opened by Jerry Plummer, Systems Development

Coordinator of the HFCC Steering Board. Ahmed Nadeem, Director of ABU Technology & Innovation, Asia-Pacific Broadcasting Union, warmly welcomed the participants to the A22 Coordination Conference on behalf of the ABU. To a question on DRM receivers, George Ross, of Trans World Radio (TWR) replied that the main manufacturers of DRM receivers were Starwaves (Germany), Gospell (China), Avion (India) etc.

During the coordination period, delegates from short wave broadcasters and frequency management organisations had an valuable opportunity to coordinate their frequencies directly with the frequency managers of other broadcasters. Out of the many requirement files submitted, a sizable number of frequencies conflicts and instances of interference were potentially eliminated by the face

to face coordination, and by e-mail coordination with others not present at the conference.

Due to the continuing coronavirus situation and the resulting travel restrictions, flight cancellations and other complications, the Steering Board had decided to make the A22 Global Coordination Conference virtual rather than in-person. It had been previously scheduled to be held physically in Tunis, Tunisia from 16 -20 January 2022.

The A22 Conference is a joint coordination of the High Frequency Coordination Conference (HFCC), the Asia-Pacific Broadcasting Union (ABU) and the Arab States Broadcasting union (ASBU). Some 94 delegates, representing 60 organisations, registered for the event. ■

WBU TECHNICAL COMMITTEE MEETING – APRIL 2022

••

The WBU Technical Committee meeting took place as an online session on the 11th April and was chaired by John Lee, the Chairman of WBU-TC from the North American Broadcasters Association (NABA).

Some of the main discussions within the agenda included issues related to WRC-23 and Cybersecurity among others. The meeting was briefed on the work of the WRC-23 Working Group. It was indicated that individual unions need to work with their members more to push them to bring the issues of concern to their local regulatory authorities. The meeting discussed the importance of a combined effort to safeguard future spectrum for broadcasting needs.

The Chairman provided a brief on the work related to Cybersecurity matters with three recommendations been worked on currently. These three recommendations, one being an update to the earlier issued media vendors recommendation, will be finalized in the coming months.

Other key points of discussion included; the 6GHz unlicensed RLAN issues; Advanced Television Systems; 5G broadcast use cases and 5G-MAG activities update.

The WBU represents all the world's major regional broadcasting unions. The ABU was represented at the meeting by Mr Ahmed Nadeem, Director Technology at the ABU. ■

World Broadcasting Unions

News from the ABU Region

JAPAN'S NHK DEVELOPS 8K SLOW-MOTION SYSTEM

NHK's Science & Technology Research Laboratories (STRL) has developed an 8K 4x slow-motion system that can record continuously at 240 frames per second. It says the technology is able to capture several hundred frames per second over long recording times, unlike previous technologies that were limited to lower resolution and several seconds of recording time.

NHK STRL says that High-speed imaging captures more frames per second so that fast-moving subjects can be portrayed smoothly, or so that fast motions can be analysed. BS4K and BS8K broadcast at 60 frames/s, so to produce smooth slow-motion video in a TV programme (mainly for sports programmes), the video must be captured at an even higher frame rate.

It describes the new system as being among content production technologies that will bring new viewing experiences, "relentlessly pursuing higher realism in video and sound and achieving production not previously possible". [ABU News]

THREE KOREAN BROADCASTERS TO STEP UP COOPERATION ON UHD TV

Three leading Korean terrestrial broadcasters, KBS, MBC and SBS, have agreed to step up cooperation on terrestrial ultra-high-definition television (UHD TV). The broadcasters signed a memorandum of understanding in Seoul with the aim of boosting cooperation in research and infrastructure development on direct reception of UHD TV.

The move came at an event at KBS headquarters in which KBS successfully demonstrated direct reception of a terrestrial UHD service on the Mark One, the first smart phone to embed support for the next-generation ATSC 3.0 broadcast standard developed by the Advanced Television Systems Committee. ATSC 3.0 is the next generation of TV broadcasting that enables TV broadcasters to become mass internet data distributors, delivering essential public services and creating new business opportunities.

KBS said the event served to reaffirm its strong commitment to direct reception of terrestrial service. This would allow public service media to deliver quality emergency services in the event of communication network disruption due to fire or earthquake in the city centre and help people secure their lives and properties. It said direct reception service was also expected to increase audience satisfaction, with outstanding content free of charge, anytime and anywhere. [ABU News]

NEW ZEALAND'S TVNZ AND RNZ TO MERGE

New Zealand broadcasters TVNZ and RNZ will merge next year, the government has announced. Both will become part of a new public media organisation, the Broadcasting Minister, Kris Faafoi, said. The announcement follows a two-and-a-half-year internal debate within the government. Mr Faafoi said he expected the new organisation, which does not yet have a name, would be operating by July next year and would provide more services online.

TVNZ and RNZ will initially keep their separate identities, operating as subsidiaries of the new entity, but the government has not ruled out subsuming them fully into the new organisation after a transition period. The new organisation would be "built on the best of both RNZ and TVNZ", Mr Faafoi said.

Mr Faafoi acknowledged that TVNZ and RNZ staff might be uneasy about change. He did not rule out job cuts but said that was not the purpose of the merger.

Since RNZ's running costs exceed the profits TVNZ normally makes from advertising sales, the new organisation is expected to be non-profit, continuing to make money from advertising but also receiving government funding, the news website Stuff said. [ABU News]

TELSTRA BROADCAST SERVICES EXPANDS WITH CINEGY

Telstra Broadcast Services (TBS), will be expanding its broadcast and playout service offerings based on the Cinegy platform. Cinegy is a premier provider of software technology for digital video processing, asset management, video compression and automation, and playout services. Products such as Cinegy Air, with its scalability, efficiency and feature-rich, intuitive usability, will form the backbone of Telstra's playout service offering.

The global media industry is expanding to cloud-enabled and software-defined capabilities. Adding new playout capabilities, running on Cinegy software modules, to TBS's existing global fibre and satellite networks, sets the company up to meet the evolving needs of the broadcast market.

By partnering with Cinegy, Telstra Broadcast Services is able to remove the shackles of traditional hardware-based solutions and capex cycles that stifle innovation said Andreas Eriksson, Head of Telstra Broadcast Services. The MediaCloud solution is setting the benchmark providing the ability to drive software with rapid ongoing development cycles, which is really powerful for our customers as it enables scale through innovation, responsive changes and agile workflows for new and existing offerings. [Content+Technology]

INDIA AND VIETNAM AGREE TO COLLABORATE ON DIGITAL MEDIA

India and Vietnam have agreed to collaborate in the field of digital media, the Press Trust of India reports. The Information and Broadcasting Ministers of the countries signed a letter of intent in New Delhi on 16 December 2021. The CEO of India's public broadcaster Prasar Bharati, Mr Shashi Shekhar Vempati, also attended the meeting.

The letter covers the sharing of information and experience in establishing policies and regulatory frameworks on digital media and social networks. It also envisages conducting capacity building and training programmes for media professionals and officials in the two countries, India's Ministry of Information and Broadcasting said. [ABU News]

AUSTRALIA'S FREE NETWORKS WANT PRIME POSITION ON SMART TVS

Australia's commercial free-to-air TV channels have called on the federal government to introduce legislation guaranteeing them prominence on smart TV home screens, the Guardian reports. They claim they are becoming hard to find among global streaming rivals such as Netflix. Televisions increasingly include apps for the various streaming services available, including Netflix, Stan, Disney+ and ABC iview, as well as the commercial channels' own apps.

Free TV Australia, which represents free-to-air stations including Seven, Nine and Ten, has flagged growing concern that the commercial stations are becoming

increasingly hard to find on smart TVs.

There was also concern that streaming-specific buttons on remote controls as well as favourable placement on smart TV home screens for other streaming services were diverting viewers away from free-to-air TV. The organisation argued that streaming companies could never replace the value of free-to-air TV. [ABU News]

SAUDI ARABIA LAUNCHES FIRST NEWS RADIO STATION

The Saudi Broadcasting Authority (SBA) has launched the country's first news radio station. Known as Al-Ekhbariya Radio, it was launched on 13 February to coincide with World Radio Day. It is a radio branch of the Al-Ekhbariya TV channel and aims at focusing on local specialised content.

The Saudi Press Agency quoted SBA's CEO, Mohammed bin Fahd Al-Harithi, as saying the launch came within the framework of the authority's strategy towards distributing media discourse across all platforms and shifting towards specialised media to meet the different tastes of the society. [ABU News]

DIGITAL TERRESTRIAL TV SET TO START IN SRI LANKA IN 2023

The first digital terrestrial television broadcasting in Sri Lanka will start in 2023, the Daily News reports.

The project to digitise Sri Lankan television broadcasting is being carried out by the Ministry of Mass Media in conjunction with the Japan International Cooperation Agency (JICA) and with financial assistance provided by the Japanese government to Sri Lanka.

One of the biggest advantages of the DTTB project is the ability to offer automatic early disaster warnings targeting specific areas for natural calamities such as floods, earth slips and even tsunamis.

In addition, broadcasters will be able to offer high quality service at a lower platform cost for all Sri Lankan viewers, and advertisers will have greater opportunities to market their products. It is planned to totally switch off the analogue broadcasting services in the country by 2027. [ABU News]

ASIASAT HAS ENTERED INTO A STRATEGIC PARTNERSHIP WITH THAI MULTI-CHANNEL OPERATOR

Satellite solutions provider AsiaSat has entered into a strategic partnership with Thai multi-channel operator Next Step to launch Thainess, a new lifestyle HD channel. In collaboration with Next

Step, AsiaSat will provide technical and marketing support to deliver Thainess to the international market, with full vertical integration that combines the power of broadcasting via satellite and live streaming by AsiaSat's subsidiary One Click Go Live to further enhance audience reach and drive engagement across different content delivery platforms.

At launch, Thainess will be joining the premium neighbourhood of more than 300 C-band TV channels on AsiaSat 7, and will enjoy access to distribution affiliates across a regional network encompassing over 250 million pay-TV homes and 500,000 hotel rooms. [APB News]

SOOKA – ASTRO'S STANDALONE STREAMING SERVICE

Going live across Malaysia in June 2021, the six-month old sooka, a standalone streaming service by Astro, is offering viewers a freemium package with a selection of ad-based content that can be expanded into broader content bundles based on multiple subscriptions plans.

To ensure the best viewing experience, Astro Malaysia chose the Kaltura TV Platform to power sooka, which is hosted on Amazon Web Services (AWS). According to Astro, Kaltura was chosen due to its multiple worldwide reference cloud TV deployments, as well as the inherent flexibility of the Kaltura TV Platform. This allowed Astro to incorporate multiple business models and payment methods, such as Google In-App Billing and Apple In-App Purchase, with Direct Carrier Billing soon to follow.

Sooka delivers live sports events like the Premier League, Euro 2020, Olympics 2020, BWF badminton, NBA, and Formula 1 as well as over 4000 hours of Malaysia's favourite Malay and Asian dramas, movies, and variety shows, with an upcoming pipeline of sooka originals and exclusives. [APB News]

NEW SIGNIANT-AWS COLLABORATION A MEDIA2CLOUD PERFECT FIT

Signiant's cloud-native software-as-a-solution (SaaS) products, Media Shuttle and Signiant, have been integrated into Media2Cloud from Amazon Web Services (AWS). With Media2Cloud, frame-level metadata is generated using machine learning (ML) and artificial intelligence (AI) from Amazon Rekognition, Amazon Transcribe and Amazon Comprehend.

With this integration, customers can take advantage of Signiant's SaaS products to transfer content directly into Amazon Simple Storage Service (Amazon S3) with

speed, reliability, and security and once the content is in the Amazon S3 bucket, Media2Cloud begins the content analysis and post-processing. Given the central role Signiant plays in moving media assets to and from the cloud, working with Media2Cloud was a perfect fit.

More than 50,000 media and entertainment organisations are connected via Media Shuttle and Signiant Jet, and Signiant software moves petabytes of content to and from AWS every month, supporting multiple aspects of the media supply chain. [APB News]

INTER BEE BEGETS STERLING SUPPORT FROM JAPAN'S MEDIA STAKEHOLDERS

Highlighting the importance of the event for Japan's broadcast and media industry, Inter BEE 2021, held at the Makuhari Messe convention centre from 17-19 November 2021, attracted over 30,000 walk-in and online visitors, revealed Satoshi Tsunakawa, representative director and chairman of the Japan Electronics and Information Technology Industries Association (JEITA).

Widely recognised by industry professionals as one of Japan's largest and most comprehensive media events, Inter BEE brings together not only professionals related to audio, video, broadcasting, communications, professional writing, and distribution, but also technicians, creators, and stakeholders in the respective industries. The annual exhibition also brings together professionals, technicians, creators, and stakeholders in the video and media industries, with "content" at its core, said show organiser JEITA. Following on from previous editions, Inter BEE 2021 provides a business space that encompasses all aspects of content creation (production), delivery (transmission), and reception (experience), supported by the products and solutions of some of the most well-known brands in the market.

Away from the exhibition halls, the conference sessions of Inter BEE 2021 discussed some of the most critical issues impacting Japan's broadcast and media industry. These include the latest trends on broadcast policies, sports broadcasting, the fostering of global partnerships to ensure a vibrant future for broadcasting, and how simulcasting can potentially preserve the future of cable TV. Inter BEE 2022 will return to the Makuhari Messe convention centre from 16-18 November 2022. [APB News]

THAILAND SET TO EXPAND TO REGIONAL DAB+

The expansion of the ongoing DAB+ trial in Bangkok Thailand was announced at the WorldDAB Technical Group meeting on December 9, 2021. With this development, the Office of the National Broadcasting and Telecommunications Commission of Thailand (NBTC) is set to coordinate the construction of 10 new transmission sites which include both National and Local DAB+ layers.

The original DAB+ trials are in Bangkok and the surrounding region and were set up in cooperation with the Royal Thai Army with the objective to establish technical parameters. This expansion will include the areas and cities of Chang Mai in the north, Khonkaen and Nakhon Ratchasima in the northeast, Pattaya and Chonburi adjacent to Bangkok, and Songkhla, Nakhon Thammarat, and the tourist centre of Phuket in the south.

Initial objectives of the trials were to establish network parameters, demonstrate interference-free audio, introduce DAB+ data services, emergency warning system and electronic programme guide and pop-up services. Given the diverse geographic features and urban development in Bangkok and regional areas, the overall aim is to achieve the most beneficial coverage and quality of sound. [radioinfo.asia]

HAIVISION SWOOPS FOR AVIWEST

Adding 5G technology and network bonding to complete its portfolio of broadcast video contribution solutions, and now claiming to be positioned as an "unrivalled" provider of low latency broadcast technology solutions for any live event, Haivision has acquired Aviwest. Aviwest is a provider of mobile IP-based video contribution systems and a pioneer in transmission of live video over cellular networks.

The company claims a history of innovation including many world firsts such as in portable cellular video transmission, live video transmission over a 4G network implementing QoS, and live 4K video transmission over a 5G network. Aviwest has also received two Emmy Awards for its SST networking technology for reliable transmission of video over bonded networks.

Once complete, the acquisition will see Haivision Incorporate Aviwest's patented network bonding technology across its products, taking advantage of the Emmy award winning SRT and SST network transport protocols.

In addition to aiming to derive long-term product development efficiencies in video encoding, cloud connectivity, and network management, Haivision will establish its second largest worldwide development facility in France, making Europe home to over half of Haivision's development team. [Rapid TV News]

QUALCOMM, ROHDE & SCHWARZ BRING END-TO-END LIVE 5G STREAMING TO MWC

Aiming to offer a clear example of the power of next-generation mobile networks in broadcast at the Mobile World Congress 2022, Rohde & Schwarz and Qualcomm Technologies are promising to show a new 5G breakthrough that they say will redefine content delivery.

To bring a live demonstration together, Rohde & Schwarz provides its end-to-end 3GPP compliant solution, comprising a 5G Broadcast enabled R&S TLU9 transmitter, supported by a Spinner filter, and the broadcast service and control centre (BSCC2.0) acting as a core network.

The 5G Broadcast solution is built on the 3GPP Rel-16 feature-set, operating in a receive-only mode (ROM), free-to-air (FTA) and without the need for a SIM card. The 5G Broadcast dedicated mode is demonstrated with a standalone broadcast high power high tower (HPHT) infrastructure while operating within the UHF band. [Rapid TV News]

DVB PROJECT RELEASES FIRST SPECS FOR 8K UHD VIDEO DELIVERY

Despite the hurdles that the industry has faced over the last eighteen months, the nascent 8K technology market has now received a boost with the news that the DVB Steering Board has approved specification updates that introduce capabilities to deliver 8K UHD video services for the first time. Pre-Covid, there had been much anticipation of 8K TV market growth given the 8K broadcast content scheduled for Summer 2020 Olympics. However, the 2020 Olympics' postponement combined with the overall economic downturn resulted in low 8K TV unit shipments in 2020.

However, things are now looking brighter and the DVB's new updates, extending existing support for the HEVC codec, are the first step in a series of key additions planned for the DVB video coding specifications. DVB says that these are designed to ensure that it continues to provide the most comprehensive and flexible" toolbox for the delivery of next generation television services via broadcast and broadband. Until now, DVB specifications included HEVC conformance points only for up to 4K resolution. [Rapid TV News]

COMCAST & IDEAL SYSTEMS ANNOUNCE STRATEGIC ALLIANCE TO SERVE ASIA PACIFIC REGION

Comcast Technology Solutions and systems integrator Ideal Systems have announced that Ideal Systems will serve as a reseller of Comcast Technology Solutions' CTSuite portfolio of products and services in the Asia Pacific (APAC) region. As part of the deal, Ideal Systems will offer companies throughout APAC access to Comcast Technology Solutions' Cloud TV Suite, Direct-to-Consumer Suite, Live Linear Suite, and VideoAI.

Fintan Mc Kiernan, CEO at Ideal Systems SEA said that Comcast Technology Solutions is renowned globally for powering video entertainment services for leading broadcasters, programmers, service providers, and brands. Companies today want more efficient and flexible ways to deliver multi-screen, cloud-based video to viewers, and this new strategic relationship with Comcast Technology Solutions is aimed at meeting this growing demand. [TV Technology]

SOUTH KOREA'S JEJU ISLAND TESTBED DELIVERS VITAL ATSC 3.0 DATA

Despite the challenges the pandemic has created for international travel over the past year and a half, testing of new ATSC 3.0-based applications and capabilities has continued at the Korea Radio Promotion Association (RAPA) Next Gen TV testbed on Jeju Island, located Southwest of the South Korean coast.

The testbed, organised and administered in cooperation with South Korea's Ministry of Science and the nation's information and communication technology (ICT) sector, has hosted over a dozen projects involving more than 40 companies during the pandemic. Many have investigated the advanced capabilities of Next Gen TV that encompass far more than simply over-the-air digital TV transmission to homes.

Distance learning, advanced emergency alerting, precise location data to enable autonomous vehicle navigation and broadcast delivery of traffic information and other services to drivers and passengers in cars and on public transportation, are among the Next Gen TV applications that have been trailed on the island. [Content+Technology] ∎

NEWS FROM THE ABU REGION

DIGITAL
BROADCASTING
Updates

DISPLAY TECHNOLOGIES TO REALISE NEW VIEWING STYLES

NHK is conducting R&D on thin and light-weight flexible displays that will enable viewers to enjoy ultra-high definition images on a large screen, even at home. This will make new viewing styles possible with screens that can be tailored for various uses, such as storing away in a small space. This series will give an overview of flexible display technology and introduce technical elements that we are researching to realise it.

The development of high-quality flexible displays requires the formation of light-emitting devices, such as organic light-emitting diodes (OLED) and thin-film transistors (TFT), to control their brightness for each pixel. TFTs are fabricated using multiple layers of thin films composed of semiconductors, metals, and other materials. Conventionally, these thin films have been formed by depositing materials on a substrate in a vacuum. However, as display sizes have increased, the size of the vacuum equipment needed to fabricate TFTs has become very large, and the cost and power consumption of such equipment has become an issue.

NHK STRL has been researching printable TFTs that do not require vacuum equipment and are fabricated by applying liquid materials to a substrate. Such solution-coating methods are promising as the next-generation semiconductor technology needed to reduce display costs, reduce energy consumption, and increase screen sizes. In earlier development, we

have printed TFTs with technologies that form thin-film patterns in a small number of steps, using low-impurity water solutions of oxide-semiconductor materials and photo reactive processes, and achieved mobility comparable to that of devices fabricated with vacuum equipment.

This technology can be applied to large-screen displays by forming the printable TFTs on a thin plastic film substrate. In addition to semiconductor materials, we are also researching printable electrode materials. In the future, research will be continued on printable TFTs, to implement large-screen, high-resolution flexible displays and make them available for home use. [NHK STRL]

DVB AND 5G-MAG JOIN FORCES ON THE FUTURE OF TV OVER 5G

The DVB Project and the 5G Media Action Group (5G-MAG) have agreed to work together to help bring the commercial deployment of 5G-based television services closer to reality. Following the signing of a formal liaison between the two organisations, a Joint Task Force (JTF) will move forward quickly with activities related to the combination of 5G systems with DVB solutions. Its work will be based on the Commercial Requirements for DVB-I over 5G, developed last year by DVB and published as DVB BlueBook C100.

The initial focus of the JTF will be to map use cases and commercial requirements for DVB-I over 5G into a set of deployment guidelines. JTF participants will also identify gaps in existing specifications, delivering technical requirements to either DVB or 5G-MAG, as appropriate. This is likely to lead to DVB, for example, updating DVB-I to signal 5G systems and extending DVB-DASH to support certain 5G-related interfaces.

The JTF may also trigger 5G-MAG work on 5G systems profiles, recommendations or updates to relevant specifications such as the ETSI specification for LTE-based 5G Terrestrial Broadcast (ETSI TS 103 720). With respect to verification and validation of the relevant

specifications, the group may provide recommendations for 5G-MAG's work on open-source software – the 5G-MAG Reference Tools – within the scope of the use cases and requirements for DVB-I over 5G. [DVB]

AUSTRALIAN GOVT REVIEWS NEWS MEDIA-DIGITAL PLATFORMS CODE

The Australian Federal Government will commence a review into the operation of the News Media and Digital Platforms Mandatory Bargaining Code to be conducted by Treasury in consultation with relevant agencies. The Code came into effect on 3 March 2021 and its governing legislation requires it to be reviewed within 12 months of operation.

A key focus for the review will be assessing the extent to which commercial agreements between the digital platforms and Australian news businesses have contributed to this objective. The Government has issued Terms of Reference to guide the Review. Treasury will issue a short consultation paper inviting submissions from news businesses (including small and regional businesses), digital platforms and other interested parties. Treasury will finalise a report to the Treasurer and the Minister for Communications, Urban Infrastructure, Cities and the Arts by the end of September 2022. [Content+Technology]

WHY MORE VIEWERS IN ASIA WILL TURN TO SVOD SERVICES?

Driven by high penetration in both fixed and mobile broadband, as well as low subscription prices, more viewers in Asia are consuming content from subscription video-on-demand (SVoD) services. Of the 698 million SVoD subscriptions that will be recorded in the region by 2026, 354 million subscriptions will come from China, with India providing 157 million subscribers, predicts Digital TV Research.

The rise in SVoD subscriptions, however, may not necessarily have a detrimental effect on traditional linear TV services in the region. Digital TV Research does not foresee a high degree of cord-cutting in Asia, except in China, where the

government is pushing for IPTV and fibre broadband over cable TV. "Cord-nevers", on the other hand, will continue to bypass all alternatives and go straight to over-the-top (OTT) or SVoD services. [APB News]

EBU TRANSFORMS EURORADIO LIVE NETWORK USING AOIP

The European Broadcasting Union is the world's leading alliance of public service media. Forty-seven of the EBU radio organisations have used the union's Euroradio Live Network to broadcast concerts and events. In 2017, the EBU radio organisations and Eurovision Services engineers agreed to replace the Euroradio Live Network equipment, most of which had reached an end-of-life state.

The challenge was to find a detachment system that would simplify the exchange of live radio concerts; deliver the quality and reliability of a satellite solution; provide extra services such as bi-lateral exchanges and applications beyond concerts; have a latency of not more than 10 seconds; and a lower total cost of ownership.

The key to connecting the 47 EBU radio organisations to the EBU Flex System was an audio over IP (AoIP) codec that could both integrate live concerts into the orchestrating EBU Flex system and receive them. [redtech.pro]

DVB ADDS VVC TO ITS VIDEO CODING TOOLBOX

The DVB Project has added Versatile Video Coding (VVC) to its core specification for the use of video and audio coding in broadcast and broadband applications. DVB is thus the first standards body of its kind to add a next generation video codec to its media delivery toolbox.

New video codecs are important enablers of enhanced video experiences for broadcast and broadband, like 8K, as well as for accelerating the adoption of 4K UHD. The addition of VVC, with further codecs to follow, ensures that DVB continues to provide the world's most comprehensive and flexible toolbox for the delivery of next generation television services via broadcast and broadband.

A new revision of the DVB-AVC specification has been approved by the DVB Steering Board and is available now as DVB BlueBook A001r19. The technical work to add next generation video codecs to DVB's specifications has been undertaken by the TM-AVC group at an impressive pace – the commercial requirements that guide the work were finalised just over eight months ago. Having completed the addition of VVC on schedule, the group is continuing to work intensively, with the AVS3 codec as the current focus and AV1 next in line for evaluation. [DVB]

KEY ATSC 3.0 TECHNOLOGIES SELECTED BY BRAZIL FOR ITS NEXT-GENERATION DIGITAL TV STANDARD

The Advanced Television Systems Committee (ATSC) announced that the Fórum Sistema Brasileiro TV Digital Terrestre (SBTVD Forum) has recommended to the Brazilian government the selection of several technologies proposed by ATSC for Brazil's next-generation terrestrial digital television standard.

The ATSC 3.0 elements selected by the SBTVD Forum, and others still under consideration, are all proven technologies in the ATSC 3.0 suite of standards – the world's first IP-based system that marries broadband and broadcast – already being implemented in South Korea and the United States and coming soon to Jamaica.

While development of "TV 3.0" specifications and some additional testing will continue over the course of the next two years, decisions made thus far selected five key technologies proposed by ATSC for both the broadcast and broadband components of the "TV 3.0" system. These are ROUTE/DASH Transport, MPEG-H Audio, IMSC1 Captions, HDR10 Video and ATSC 3.0 Advanced Emergency Alerting. Brazil plans to begin deployment of its TV 3.0 system in 2024. [businesswire.com]

THE EBU HAS PUBLISHED RECOMMENDATION R 155

The EBU has published Recommendation R 155, which provides guidance for broadcasters and the industry to better deal with non-traditional aspect ratios.

Titled 'Archival of Vertical Aspect Ratio Video', the EBU R 155 document outlines best practices to avoid unnecessary degradation and preserve the full resolution of footage recorded in non-traditional (e.g. 9:16) aspect ratios during archival. It also outlines guidelines for the recording of footage in 16:9 that is destined to be repurposed for other aspect ratios down the line.

This EBU Recommendation was triggered by, and created with the help of, CBC/Radio-Canada, following the launch of a successful series of services by the Canadian broadcaster that aims to provide local news programming built on user-generated content and social media for distribution.
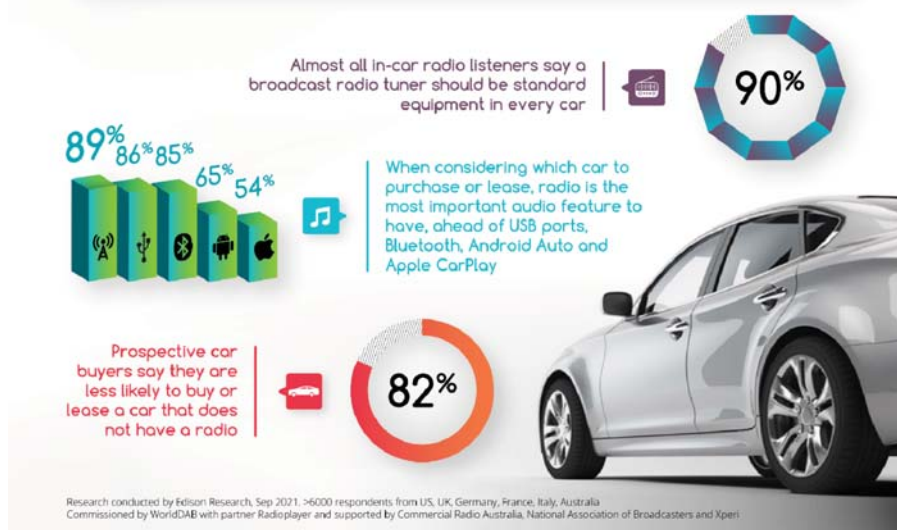
R 155 contains simple-to-follow guidelines and encapsulates the best practices developed by the Canadian broadcaster and their European counterparts. It is directed at broadcasters and content creators as well as vendors seeking to optimise their solutions. [EBU Tech]

RADIO REMAINS CRUCIAL FOR CONNECTED CARS

Radio station operators must tell vehicle manufacturers about the importance of broadcast radio remaining easily accessible in the car of the future. That was the strong message from Joan Warner, CEO of Commercial Radio Australia, speaking at the WorldDAB Summit last November – an annual event bringing together key digital radio stakeholders from around the globe. Warner, who steps down after over 20 years in the role, highlighted new findings from Edison Research showing that drivers and their passengers love to listen to radio in the car.

Warner emphasised that broadcasters continue to innovate to maintain relevance in the digital age. However, she also cautioned that connected cars are now changing the face of the vehicle industry. As a result, Commercial Radio Australia has called on the federal government to pass regulations to ensure that new and connected cars entering

CAR BUYERS SAY BROADCAST RADIO IS A MUST

Almost all in-car radio listeners say a broadcast radio tuner should be standard equipment in every car — 90%

89% 86% 85% 65% 54%

When considering which car to purchase or lease, radio is the most important audio feature to have, ahead of USB ports, Bluetooth, Android Auto and Apple CarPlay

Prospective car buyers say they are less likely to buy or lease a car that does not have a radio — 82%

Research conducted by Edison Research, Sep 2021. >6000 respondents from US, UK, Germany, France, Italy, Australia Commissioned by WorldDAB with partner Radioplayer and supported by Commercial Radio Australia, National Association of Broadcasters and Xperi

the country from 2023 have local broadcast radio prominent on entertainment screens.

Warner set out the two key benefits such a move would bring. The car buyers survey tells that 91% of Australian car radio listeners regard radio as company in the car and Unlike Spotify or other global media streaming services, only broadcast radio can provide a live and hyperlocal voice and offer drivers original and compelling local content. Radio is the trusted and authentic voice of the community. [WorldDAB]

CHANGING PERSPECTIVES ON SOCIAL MEDIA PLATFORMS AMONG PSM

A recent EBU report explores how public service media are using social media. Social media are crucial for public service media (PSM): 66% state that those platforms are very important to them, and none say that they are not important. It comes as no surprise that the most popular social media platforms are also the most important ones for PSM. Yet things are starting to change. Facebook leads the way by far, with 100% of surveyed PSM being present on the platform and three quarters considering it as strategic. Nonetheless, it has lost some of its shine, especially among younger audiences. TikTok and Twitch are the platforms with the greatest potential for adoption by PSM – many think about joining those newer platforms. When looking at where PSM plan to increase their efforts, Instagram

comes as the top priority, with 66% of those surveyed planning to increase their efforts on the platform. TikTok comes second.

Even if fewer PSM are on this platform, the ones that are clearly see the importance of having an active presence there. It is also evident that PSM are completely disengaging with Snapchat, and Twitter and Facebook are not in a good spot either. Not all social platforms are strategic for PSM and they use them for different purposes. PSM use YouTube and TikTok to reach specific audiences, especially younger ones, while Facebook and Twitter are used more often for promotion and to drive traffic to PSM-owned websites. The purpose of Instagram is a little bit less defined among PSM – it goes from increasing reach to building and engaging with communities. [EBU Tech]

DIGITAL UK MAKES CLEAN SWEEP OF UK BROADCASTERS

Adding the UK's youngest broadcaster to its ranks, Digital UK has announced that Channel 5 is joining UK public service broadcasters BBC, ITV and Channel 4 in entering into a new Digital UK members' agreement, marking the first time has included all four PSBs. Digital UK is the joint venture which leads the future development of free TV in the UK. Working in partnership with organisations across the industry, its focus is on delivering resilient, universal, high-quality and innovative free TV services for all UK viewers.

Following the acquisition of Freesat in the summer of 2021, Digital UK is responsible for the day-to-day management of both the UK's leading free-to-view platforms, Freeview and Freesat. Earlier this year Digital UK merged with Freesat (UK) Ltd to bring the two free-to-view TV organisations together, with the aim of ensuring that viewers continue to have access to a range of free-to-view TV services in the UK, while also benefitting from technological innovations and developments across the two platforms. [Rapid TV News]

WDR USES AIXTREAM TO COMBINE INTERNET STREAMING AND DVB MULTIPLEXING

The German public broadcaster Westdeutscher Rundfunk is successfully using Ferncast's aixtream software to combine internet streaming and DVB multiplexing. WDR provides a wide-ranging selection of different radio programmes in various formats to the German audience. In 2020 it wanted to find a way to perform all internet streaming (Icecast and HLS) and DVB multiplexing on as few individual systems as possible to reduce costs and complexity of logistics. It also wanted to simplify the workflow and operation to reuse the same signal for as many outputs as possible. Ferncast GmbH presented aixtream as a solution.

WDR finished implementing the software in September 2021. WDR now streams 36 different programmes with aixtream software, including 1LIVE, WDR2, WDR3, WDR4, WDR5, WDR COSMO, Selektor, Die Maus, WDR Event, WDR VERA.

All the programmes are available in multiple formats and quality levels. In total, each programme is streamed in at least five formats and qualities. HLS streams are available in three quality levels using adaptive bitrate to adjust to the listener's circumstances, while Icecast streams are available in at least two quality levels. [redtech. pro] ■

Equipment *Trends*

DEJERO ENGO 265 LTE MOBILE TRANSMITTER AND INTERNET GATEWAY

Reliable, simple to use, and built tough for field use, EnGo 265 is designed for mobile video professionals who demand high performance. EnGo 265 efficiently encodes and securely transmits high-quality live video from the field while also empowering mobile teams to work more efficiently with resilient, high-bandwidth, wireless internet access. Featuring our renowned Smart Blending Technology, the dependable EnGo 265

reliably performs in the most challenging network conditions. Worn in a backpack or mounted in a vehicle for use with roof-top antennas, EnGo 265 is ideal for newsgathering, sports coverage, live event production, and transmitting real-time video from drones.

Key Features:
Smart Blending Technology Aggregate 3G/4G/LTE-A, external 5G, Wi-Fi, Ethernet, and portable satellite connections. Hardware/software encoding dynamically adapts in real-time based on the complexity of the video scene being captured and the network throughput. Advanced RF and antenna design for ultra-reliable transmission and reception. 5″ capacitive touch screen provides confidence monitoring, status information, and in-field control. Includes shoulder-mounted wired remote, sun shade, simplified cable management, and space for optional external battery. Mount inside a vehicle and connect to external antennas with optional dock Travel-friendly Integrated global modems, global roaming connectivity services, field-accessible SIMs, and an internal battery that's aircraft carry-on compliant. Over 3 hours of battery life from rechargeable internal battery, plus

optional use of external ENG camera batteries for extended runtime. One-way IFB over wired or Bluetooth* earpiece, and two-way, full-duplex Intercom voice communication Return Video Connect external display to HDMI output to view a low latency feed from the studio. Works seamlessly with unmanned aerial systems to capture real-time video from unique vantage points.

IMAGINE 1RU SNP INTEGRATOR AS A PART OF PANASONIC KAIROS IP LIVE VIDEO PRODUCTION PLATFORM

As broadcasters and production companies transition towards IP infrastructures, a technology partnership between Imagine Communications and Panasonic is delivering practical, easily implemented and highly efficient hybrid and IP solutions using open standards-based products. In yet another application for Imagine's widely deployed **Selenio™ Network Processor** (SNP), integrators are using the software-based media processing platform to provide a high-density SDI on- and off-ramp for the Panasonic KAIROS IP live video production platform.

Imagine Communications is a KAIROS Alliance Partner. The Alliance encourages vendors to collaborate in areas like SMPTE ST 2110 interoperability and device connection verification to simplify the implementation of hybrid and IP systems.

The powerful 1RU SNP platform hosting a broad range of processing functions, it will handle conversions between ST

2110 and SDI, including 12G SDI as required, as well as up-, down- and cross-conversion between HD/UHD and SDR/HDR formats. It also offers an HDR-capable production multiviewer personality, SNP-MV, which can integrate content from different video formats and HDR systems into a consistent display environment. The **latest SNP release** incorporates JPEG XS compression capabilities to provide production-quality, low-latency interconnection that enables remote production workflows. The innovative design of the SNP enables the device to be easily reconfigured with any of these personalities, as well as ensuring the SNP can be field-upgraded to support new functionality as additional software modules are developed.

Panasonic's KAIROS platform offers an open architecture system for live video switching with complete input and output flexibility, resolution and format independence, maximum CPU/GPU processor utilisation and virtually unlimited ME scalability. As a native IP, ST 2110 system, KAIROS supports transitions to live IP workflows and can eliminate

dedicated hardware constraints.

AJA BRIDGE LIVE

AJA BRIDGE LIVE is a broadcast-quality, low-latency turnkey system for Remote Production (REMI), Multi-Channel Video Contribution, Remote Collaboration, Direct to Audience Streaming and Multi Bit Rate/Format Delivery.

Equipped with 12G-SDI I/O plus the power and flexibility to enable real-time bi-directional encoding, decoding and transcoding for critical UHD and HD workflows, BRIDGE LIVE is an essential part of any modern live video production toolkit. A compact and robust 1RU form factor with redundant power supplies.

Whether facilitating remote production, two-way interviews, live event streaming, multi-cam backhaul, field contribution, program return, confidence monitoring, collaborative production, ABR ladder profiles to hand-off for OTT packaging, BRIDGE LIVE ensures simultaneous, secure and stable workflows whether over private lines or the public internet.

Features:
12G-SDI/3G-SDI I/O supports 4-channels of HD or 1-channel of UltraHD as standard. Bi-directional Encode/Decode/Transcode; NDI, H.265 (HEVC), H.264 (AVC, MPEG-4), H.262 (MPEG-2) and JPEG 2000 (TR-01). Protocols; SRT, HLS, MPEG-TS, MPTS (input), RTMP/RTMPS (output), RTP, and UDP. Multi bit rate/format content distribution, ABR Ladder Profiles for OTT hand-off. Selectable profiles for 10-bit and 8-bit, 4:2:2 and 4:2:0. Unmatched Metadata capabilities including Ad insertion markers (SCTE-35/SCTE-104), CC/Subtitles (EIA-608/708, Line 21, H.264 SEI), MPEG-2 ANC, SMPTE 2038. Remote WebUI or local GUI access for easy administration, control and operation. Monitoring, Control and Automation supported via REST API or SNMP. Turnkey 1RU rack-mountable, enterprise-class form factor. Dual 10GbE interface for control and transport. Dual power supplies for critical application redundancy.

HITACHI KOKUSAI TO UNVEIL SK-UHD7000 4K ULTRA HD BROADCAST AND LIVE PRODUCTION CAMERA

The SK-UHD7000 incorporates three 2/3″, global shutter CMOS image sensors with native 4K resolution, enabling pristine capture of 3840x2160 Ultra HD (UHD) video. A new prism design with expanded spectral range fully complies with all international colorimetry specifications and enables superior colour reproduction. The high-performance sensors and new prism combine to enable full-range BT.2020 UHD Wide Colour Gamut (WCG) capture. A dual 4K and HDTV workflow supports separate controls for Hybrid Log Gamma (HLG) High Dynamic Range (HDR) and standard dynamic range (SDR).

EQUIPMENT TRENDS

The SK-UHD7000 continues the SK-UHD4000's hallmarks of delivering extraordinary sensitivity and quality for Ultra HD production. Sensitivity of F11 at 59.94 frames per second enables high-quality acquisition in limited lighting, while a signal-to-noise ratio (SNR) of 62 dB provides ultra-quiet images. Advanced digital processing technology and a wide array of image refinement tools enable precise tailoring of the accuracy and look of productions. Operational features such as focus assist and viewfinder zoom make it easier for users to perform critical focus at 4K resolution. The SK-UHD7000's powerful new processor also provides plenty of headroom for additional functionality in the future.

NEWTEK PTZ3

NewTek, a Vizrt Group company, has launched the PTZ3, a pan-tilt-zoom (PTZ) camera that uses the NDI|HX 3 standard built by NDI to provide an option for better video with reduced latency.

The PTZ3 is an IP-based pan-tilt-zoom camera that delivers high-quality, high-definition video to the network and interoperability with any of the thousands of applications that support NDI.

With single cable connectivity, the PTZ3 allows video professionals, technology managers, and A/V systems integrators to explore new ways to expand, grow, and evolve productions using their network, while simultaneously streamlining integration and installation by incorporating power over Ethernet.

The first camera to support the new

NDI|HX 3 standard, the PTZ3 is also equipped with professional-level audio connectivity.

Featuring a professional mini-XLR mic input connection in addition to a line level mini-jack, the PTZ3 delivers clean, balanced audio directly from the camera into the NDI network. Connected on the NDI network, the PTZ3 audio can be routed, mixed, enhanced, and distributed to thousands of devices and software.

ROHDE & SCHWARZ PRESENTS FIRST AUTOMATED TEST SOLUTION FOR HIGH-SPEED ETHERNET CABLE ASSEMBLIES UP TO IEEE 802.3CK

New compliance test automation

software from Rohde & Schwarz for IEEE 802.3 cable assemblies allows for precise and time-saving compliance tests of high-speed cables and backplanes according to the IEEE 802.3bj, by, cd and ck standards. The R&S ZNrun vector network analyser automation suite controls a vector network analyser and a switching solution from Rohde & Schwarz to provide automated testing of high-speed Ethernet cable assemblies, considerably reducing the testing time and potential errors compared to manual Ethernet cable assembly test methods.

As the volume of data transferred via internet and the number of data centres across the world increase, proper testing of Ethernet cable assemblies becomes crucial. As direct attach copper (DAC) cables are the most economical solution for short data connections, they are widely used in high-speed networks and data centres. Installations include a huge number of these DAC cables, and their performance is vital for the whole system. IEEE 802.3bj and IEEE 802.3by cover data rates of 25 Gbps per lane, IEEE 802.3cd goes up to 50 Gbps per lane.

The latest IEEE 802.3ck standard further doubles the data rate to 100 Gbps per lane, enabling cable assembly configurations of 100GBASE-CR1, 200GBASE-CR2, 400GBASE-CR4 and 800GBASE-CR8. ■
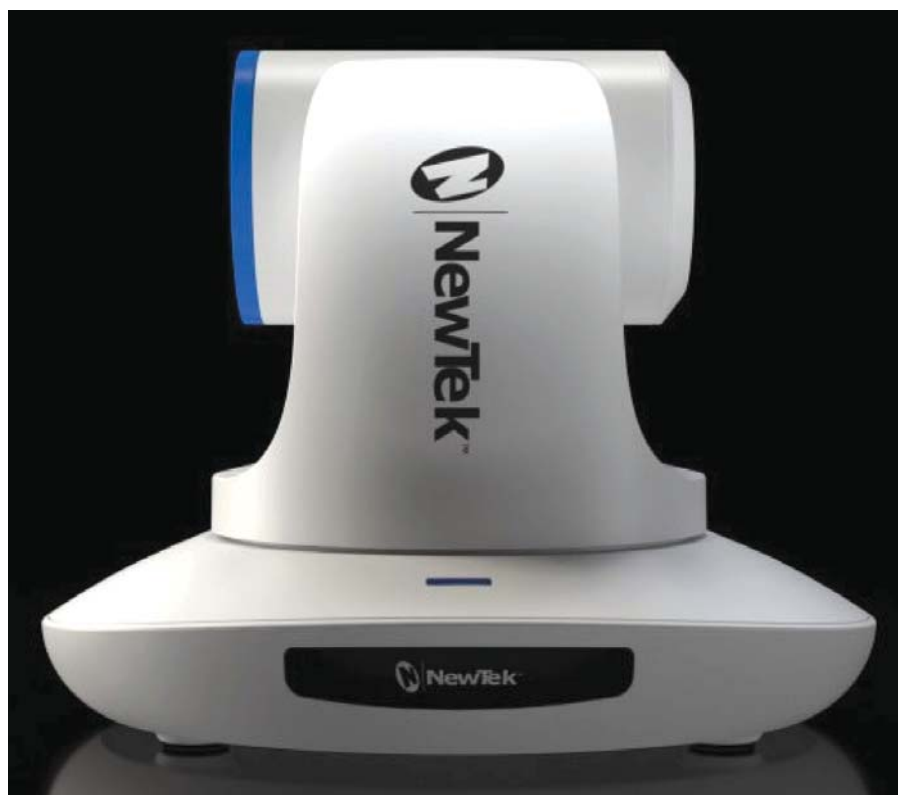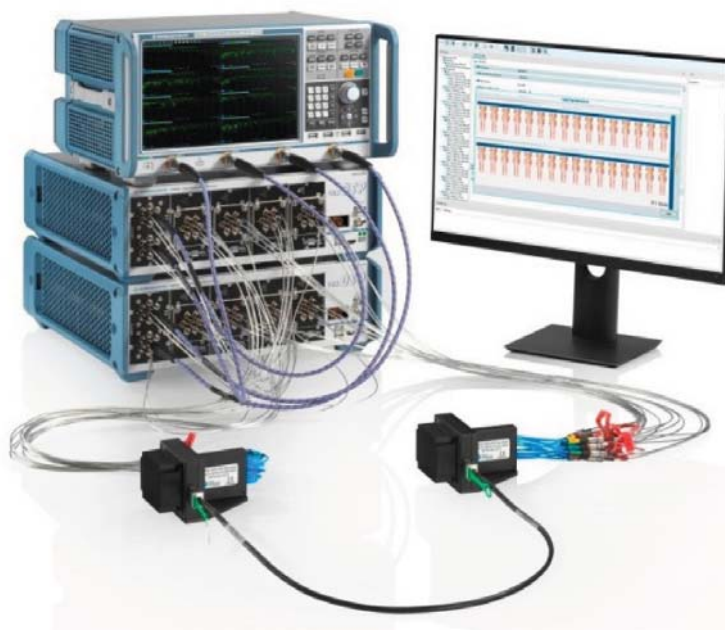
DBS2022 TEAM

The team was led by Mr Ahmed Nadeem, who had initiated a new platform to cater to the specific needs for running DBS 2022.

ABU Technology opted for the 'Restream Studio' platform which provides a studio production-like environment to bring together its speakers and presenters. Restream's cloud-based 'Restream Studio' application allows multiple layers of customisation, including custom backgrounds, captions, logo insertion etc. and different presenter layouts, to arrange multiple speakers within the screen/window.

Prior to the event, the team members discovered another platform called Soliton – a video switcher on a cloud platform that helps to switch or choose between different audio or video sources.

In addition, OBS Studio (Open Broadcaster Software), a free and open-source software suite for production, recording and live streaming applications, was used to combine the live sessions with promo clips, titles, timer etc.

The ABU's Asia-Pacific View (APV) platform, which is built on the AWS cloud infrastructure, was used for live streaming and as a content repository for promo clips and recorded sessions.

Also utilised were:
Slido, an easy-to-use online Q&A and polling app, embedded on the conference webpage, allowing participants to interact and engage during presentations.

Tidio, which combines live chat and chatbot in one tool, to help provide easy and smooth customer service. It enables the host to engage with visitors in real time, send personalised messages, and offer help via chatbots, anytime and anywhere. It connects to Messenger, Instagram, and e-mail, allowing the host to manage all communication channels from one place.

PHP Live, a MySQL powered live chat software for websites, allowing chat with website visitors and providing real-time customer support via live chat. ■

NEW *Member*

CANARA LIGHTING INDUSTRIES PVT. LTD.- India
Canara Lighting has been a global leader in the business of providing broadcast and TV studio lighting systems for over 45 years. They are the biggest manufacturers of specialised lighting equipment in South Asia and the Middle East. Their world-class and fully integrated manufacturing facility is located in Mangalore, India. Canara provides a one-stop service from concept to commissioning. This includes consulting, designing, manufacturing, research and development, installation, commissioning, training, and after-sales service.

Canara Lighting provides complete turnkey solutions for TV studios. The product range covers the latest technology in LED lighting fixtures, grid and rigging equipment (both fixed and motorised), cable management systems, electrical panels and lighting consoles. Their products are in line with international standards and are CE certified.

Canara Lighting has completed many high-end TV studio lighting projects in Asia, the Middle East, Africa and Eastern Europe, with total satisfaction. Over 1000 installations are working in different parts of the world. The customer is assured of trouble-free and efficient product delivery and services at competitive prices.

Canara Lighting equipment and lighting solutions are also used effectively in film studio lighting, auditorium and convention centre lighting, stadium indoor and outdoor lighting, sound and light shows, including façade lighting, 3D projection mapping and musical fountains. ■

Personalities *& Posts*

NEW TECHNICAL LIAISON OFFICER

Mr Muhamad Sujai replaces Mr Rahadian Gingging, RRI-Indonesia

Mr Muhamad Sujai

Mr Muhamad Sujai has been appointed the ABU Technical Liaison Officer for RRI-Indonesia. Mr Sujai has over 30+ years of continuous advancement and expertise in Marketing and Sales, Public Relations, Advertising and Media, experienced in Managerial and Director position

from the year 2000, until the present.

Sujai has extensive work experience, the majority of which he gained as a broadcaster at Radio OZ FM in 1988-1989, Radio MGT FM in 1989-1990, and Radio Ardan in 1990-1993. Sujai also worked as an Account Executive at Cipta Kalyana Advertising from 1993 to 1994, a PR Officer at PT Indosat from 1994 to 2000, a PR Manager at PT Indosatcom Adimarga from 2000 to 2002, a PR and Sales Retail Manager at PT Indosat M2 from 2002 to 2008, a Marketing Comm Manager at PT Indosat from 2008 to 2010, and a Marketing Comm Division Head at PT Indosat from 2010 to 2014. He is currently acting as the Technology and New Media Director at RRI-Indonesia.

We would like to take this opportunity to thank **Mr Rahadian Gingging** for his contribution to the ABU Technical Bureau. His enthusiasm and support to the ABU Technology Department and the Bureau will be missed. ■

Mr Rahadian Gingging

ABU TECHNICAL BUREAU MEMBER FOR KBS-KOREA

Ms Dajin Jeong, Deputy General Manager, Technology Administration at KBS, has been appointed the new ABU Technical Bureau Member representing KBS. Ms Dajin will also play the role of Technical Liaison Officer for KBS. She joined KBS in 2012 and came to the head office after three years of regional work in Daejeon, working in the Investment Strategy Department on budgeting and operating KBS's overall broadcasting technology.

Ms Dajin then transferred to the KBS Broadcasting Equipment Certification Centre, where she assisted in obtaining the qualification of an internationally accredited testing institute for UHDTV radio facility standards. She is currently in charge of the KBS in-house contest, the Media Creative Technology Contest, and technical cooperation in the Technology Management department. We extend a warm welcome to Ms Dajin.

We would like to take this opportunity to thank **Mr Dae Hoon Choi** for his contribution to the ABU Technical Bureau. We will miss his energy, enthusiasm and support to the ABU Technology Department and the Bureau. ◼

Ms Dajin Jeong

Mr Dae Hoon Choi

FORD ENNALS NAMED NEW COMMERCIAL RADIO AUSTRALIA CEO

Ford Ennals was named CEO of Commercial Radio Australia (CRA), an industry group that represents commercial radio broadcasters in Australia taking over from Ms Joan Warner, who left her post at the end of March. From his time as CEO of Digital UK and now as CEO of Digital Radio UK, he gained extensive experience in media transformation and digitisation. Broadcasters from the BBC, ITV, Channel 4, and Channel Five formed the joint venture called Digital UK and Mr. Ennals was in charge of working with broadcasters and the UK government to ensure that all UK homes were successfully converted to digital television. He has worked with the BBC, Global, Bauer, and Arqiva, among others, to lead the UK radio industry's transition to digital listening. ◼

FAREWELL TO JOAN WARNER

Stepping down from her outstanding tenure at Commercial Radio Australia (CRA), where she has provided dynamic leadership over the past 21 years, **Joan Warner** also steps down as the long-standing Vice-President of WorldDAB and Chair of WorldDAB's Asia Pacific Committee. In these roles, and as the DAB+ champion in the region, Joan worked with regulators and broadcasters to advance and assist with the rollout of DAB+ technology in order to improve radio services to listeners across the Asia-Pacific region.

She has worked tirelessly to promote DAB+ broadcast digital radio, helping broadcasters across the APAC region to understand the benefits of the technology. ◼

ABU Welcomes Sharzuan and Najwa A'liah

We welcome **Mr Sharzuan Mat** to the ABU as Systems Support Officer to the IT Department. Mr. Sharzuan has about ten years of experience in IT support and system administration. He has previously worked in the medical, legal, and oil and gas industries. Previously, he attained his Bachelor of Science in Engineering Technology from UniKL-British Malaysia Institute.

Mr Sharzuan Mat

Najwa A'liah Fairuz enters ABU as Assistant to the Director, ABU Technology from the private Malaysian company, Karex Berhad, where she served as a Strategic Partnership Executive. Her responsibilities included partnership, communications, branding, creatives, and liaison with Southeast Asian countries for product promotion and development. Najwa holds a Bachelor's Degree (Hons.) in English for Professional Communication and a Diploma in Public Administration from Universiti Teknologi MARA (UiTM). ■

Ms Najwa A'liah

ABU TECHNOLOGY
CALENDAR *of Events*
2022

11 APRIL	**ONLINE**
Training Course on Engineering Fundamentals for Broadcasters Online (Level 2)	

29 APRIL	**ONLINE**
Webinar Series on Member Innovations	

24-25 MAY	**ONLINE**
ABU Virtual Forum on Cybersecurity & Media	

1-3 JUNE	**SINGAPORE/HYBRID**
Broadcast Asia 2022	

29 JUNE-1 JULY	**COEX KOREA**
KOBA Show	

25-27 JULY	**HYBRID**
Workshop on Cloud Applications for Broadcasters	

28-29 JULY	**HYBRID**
ABU Techincal Bureau mid-year Meeting	

AUGUST	**PHYSICAL/HYBRID**
Workshop on Archiving and Media Management	

SEPTEMBER	**ONLINE**
Annual Webinar Series 2022	

SEPTEMBER	**RAI, AMSTERDAM**
IBC 2022	

OCTOBER	**PHYSICAL/HYBRID**
Workshop on IP Infrastructure & Applications	

16-18 NOVEMBER	**MAKUHARI MESSE**
Inter BEE 2022 (Hybrid)	

25 NOVEMBER	**NEW DELHI, INDIA**
ABU Technical Bureau Annual Meeting	

25-30 NOVEMBER	**NEW DELHI, INDIA**
ABU General Assembly	

26-27 NOVEMBER	**NEW DELHI, INDIA**
ABU Technical Committee Meeting	

Geraldine Peters-Williams is a familiar face to ABU members and colleagues. She joined the ABU in 1996 and has worked with three Secretary-Generals and five Directors of the Technology Division. She is one of the ABU's longest-serving employees.

Over the course of more than two decades, Geraldine has earned a reputation for being a dedicated and professional employee of the ABU. Her calm demeanour and strong work ethics have greatly aided in the growth of the network and one of the ABU's flagship events, the Digital Broadcasting Symposium, which has grown from less than five to more than sixty booths and from a few hundred to over one thousand participants in the last 18 years.

Geraldine, a Project Coordinator in the Technology Department, bid the Secretariat farewell on March 5th 2022. Mr. Nadeem, the Director of the Technology Department, said that working with Geraldine had been the most rewarding experience of his life, "Geraldine would take care of everything before I even knew about it. She's a one-of-a-kind individual."

It is with heavy hearts that we say our farewells to Geraldine on behalf of everyone at ABU, but especially on behalf of the technology team, who will miss her greatly. We wish you all the best in your future endeavours. ∎

"Thank you and farewell, Geraldine."

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