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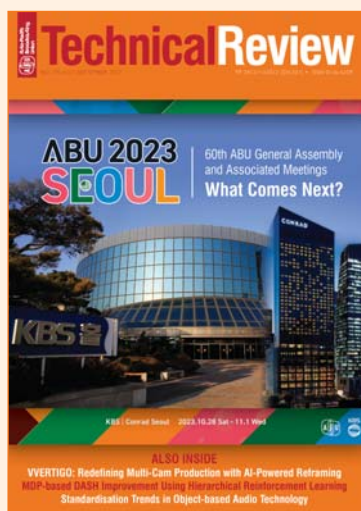
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Cover: 60th ABU General Assembly and Associated Meetings to be hosted by KBS in Seoul, South Korea

from The Editor

Dear esteemed readers,

Welcome to the 295th edition of the Technical Review, chronicling the advancements and shifts of the third quarter of 2023. With each quarterly issue, we endeavour to capture the pulse of the industry, tracing its technological strides and exploring the innovations that promise to reshape our broadcasting landscape.

In this edition, we journey through a rich tapestry of advancements. Leading the way is the transformative power of VVERTIGO, an AI-driven marvel that is reimagining the very essence of multi-cam production. As we delve deeper, the intricacies of the MDP-Based DASH Improvement beckon, showcasing the boundless possibilities of enhancing user experiences in video streaming.

Our exploration continues with comprehensive workshops, from the nuances of DAB+ systems to the ever-evolving realm of media management. Each article, each expert insight, is meticulously curated to ensure our readers receive a holistic understanding of where the industry stands and where it's headed.

Offering a unique perspective, our exclusive interview with KBS's Executive Managing Director (Technology), Kim Byung-Kook, promises a deep dive into the visionary minds steering the future of broadcasting. His insights, combined with the collective wisdom of industry stalwarts featured in this issue, make for a compelling read.

But as we navigate this compendium of knowledge, I'd like to spotlight a crucial upcoming event. The ABU Technical Committee Meeting, marked for the 28th and 29th of October, stands as a testament to our industry's collaborative spirit. Hosted by the Korean Broadcasting System (KBS), and serving as a linchpin of the ABU's 60th General Assembly and Associated Meetings, this gathering holds paramount importance. While our coverage in this edition offers just a glimpse, I urge and warmly invite all our readers to be a part of this momentous event. Your participation will not only enrich the discussions but will also help chart the future course of broadcasting.

In closing, this issue is more than just pages of information; it's a beacon for the future of broadcasting. Here's to embarking on another enlightening journey together, and to the collective growth and evolution of our beloved industry.

Warmest regards,
Dr Veyssel Binbay
veyssel@abu.org.my

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VVERTIGO: REDEFINING MULTI-CAM PRODUCTION WITH AI-POWERED REFRAMING

ABSTRACT

With the popularisation of multi-camera editing environments, the number of cameras used in broadcast media programme production is increasing. This study presents a case of efficiently reducing camera deployment in multi-camera production by introducing a reframing method. The criteria for selecting the optimal high-resolution camera were a full-frame sensor, support for 8K resolution, and continuous recording for more than 2 hours. To enhance object tracking performance, a dataset for AI training was constructed from the KBS archive, reducing the mis-detection rate by 4.7 times compared to the existing model in cluster generation tasks. Parallel rendering technology using GPUs processed 8K resolution videos at three times the speed. Based on this technology, an independently executable software called VVERTIGO was developed and utilised in music performance fancams and variety show panel reactions. This successfully reduced the camera deployment by more than half compared to the previous methods. Future plans include applying this to various genres such as sports and live commerce through improvements in AI tracking performance.

1. INTRODUCTION

Broadcast media production invariably employs multiple cameras. With the widespread adoption of non-linear editing (NLE) based multi-camera editing environments, the number of cameras used for programmes such as music performances and variety shows has been steadily increasing. For instance, Music Bank, a KBS music show, offers individual fancams for each member of the performing artists, while Fun-Staurant, a KBS variety show, involves eight panellists, necessitating various shot angles for capturing reactions. Such programmes typically demand approximately from 10 to 20 cameras, with the number of cameras directly influencing production costs. Introducing an additional camera invariably requires supplementary resources, such as a director, auxiliary staff, equipment rental, and transportation.

The spread of COVID-19 has underscored the importance of reducing population density within studios. In response, the Korea Communications Commission introduced guidelines for "Broadcast Media Production Site Quarantine Management," which outlined restrictions on the concentration of workers based on social distancing levels [See KCC Broadcasting Production Site Quarantine Management Guidelines, <https://kcc.go.kr/user.do?boardId=1112&page=A05020000&dc=K00000200&boardSeq=51559&mode=view>]. This situation underscored the need to reduce the number of cameras.

Consequently, we decided to adopt a method of capturing multiple subjects with a single camera, tracking their movements, and then reframing. To realise this reframing approach, several conditions must be met. Firstly, the use of ultra-high-resolution cameras is essential. To capture 3 to 4 subjects with only one camera, a minimum resolution of 8K is necessary. Secondly, AI-based technology is required to track the movements of subjects, allowing the role of the camera director to be shifted to the post-production editing process. Thirdly, parallel GPU-based rendering acceleration technology is essential to process high-resolution footage.

In Chapter 2 of this paper, we will delve into the system configuration, Chapter 3 will discuss the use cases for multi-cam production, and Chapter 4 will present the conclusion.

2. SYSTEM CONFIGURATION

2.1 Camera selection

Reframing refers to the technique of applying cropping and panning to a video to generate a new frame [See Wikipedia, [https://en.wikipedia.org/wiki/Reframing_\(filmmaking\)](https://en.wikipedia.org/wiki/Reframing_(filmmaking))]. To capture multiple subjects with a single camera, a high resolution is essential. Based on our internal experiments, an 8K resolution allows reframing for up to four individuals in a 16:9 aspect ratio and up to ten individuals in a 9:16 aspect ratio, all at a 2K resolution.



Figure 1. Examples of 9:16 vertical ratio videos created by reframing 8K footage

In variety shows like KBS Fun-Staurant, the recording time for reactions spans approximately 12 hours, with a single continuous shot lasting around 120 minutes. Consequently, the continuous recording capability becomes a pivotal factor in camera selection. Cameras with 8K recording time limitations due to overheating issues were excluded from our choices. Moreover, considering the realistic limitations of storage capacity, products employing high-efficiency codecs like HEVC were favoured. At 8K 60p, the bitrate for ProRes422 stands at 5,000 Mbps, while HEVC operates at a more efficient rate of approximately 400 Mbps.

Sensor size and resolution are directly proportional. The sensor sizes increase in the order of MFT, Super35, and

FullFrame. The resolution difference between MFT and FullFrame is discernible even to the naked eye, with significant disparities in peripheral resolution. Equipment cost was also a consideration, setting a threshold of USD 10K.

Given these criteria, we chose for the EOS R5 C model in this study. Detailed specifications can be found in **Table 1**.

2.2 User Interface

The user interface (UI) configuration of VVERTIGO, as proposed in this study, is shown in the **Figure 2**. The UI is designed to effectively execute a series of AI-powered reframing tasks to produce individual videos from an 8K footage.

Table 1. Comparison of High-Resolution Camera Specifications

Model	Sensor type	Resolution	Recording Limits	Codec@Bitrate	Price
EOS R5 C	FullFrame	8K 60p	Unlimited	HEVC@400Mbps	Under \$10k
Alpha 1	FullFrame	8K 30p	30min	HEVC@520Mbps	Under \$10k
DC-S1h	FullFrame	6K 30p	Unlimited	HEVC@200Mbps	Under \$10k
EOS R5	FullFrame	8K 30p	30min	HEVC@200Mbps	Under \$10k
8K ROI	FullFrame	8K 60p	Not supported	Not supported	Over \$10k
V-RAPTOR (~VistaVision)	FullFrame	8K 120p	Unlimited	R3D@800Mbps	Over \$10k
G1	MFT	8K 30p	Unlimited	HEVC@600Mbps	Under \$10k
AB-4815	Super35	8K 120p	Not supported	Not supported	Over \$10k

- **Pre-edit:** Users can adjust the length of the input video and perform corrections for video distortion and colour. Corrections at this initial stage contribute to enhancing the AI's performance.



Figure 2. UI for pre-edit step

- **Keyframe Edit:** The trajectories of subjects, derived from AI analysis, can be visually inspected. Based on the results of person detection and clustering, users can adjust the trajectories for each individual.



Figure 3. UI for keyframe edit step

- **Video Edit:** Post-production tasks for the finalised individual videos can be carried out, allowing for the insertion of additional resources such as logos or intro videos.

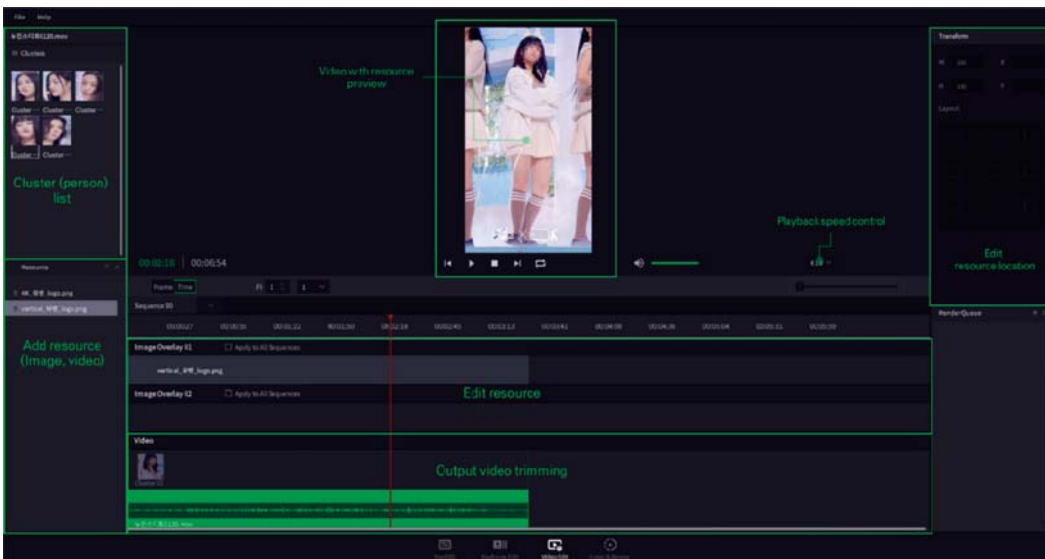


Figure 4. UI for video edit step

- Colour & Render:** Colour correction and preview before rendering the output video. Set various parameters for video rendering, including codec, frame rate, bitrate, and resolution. A real-time preview is available without rendering to ensure all keyframes are correct. The final render task can be added to a queue, allowing for real-time monitoring of its progress.

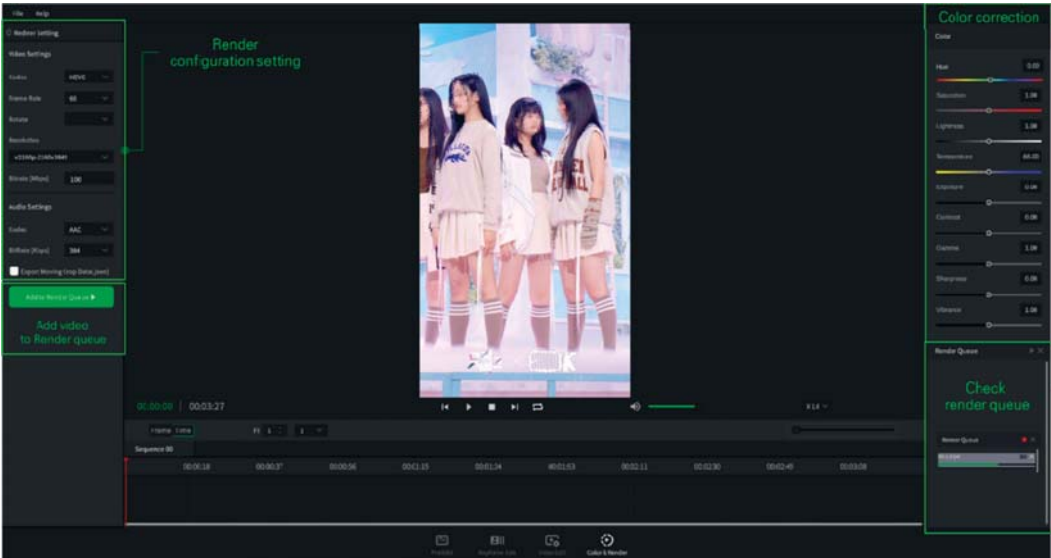


Figure 5. UI for Color&Render step

Through this configuration, VVERTIGO offers efficient processing of 8K footage and a user-friendly video editing environment.

2.3 AI trajectory generator

In the process of individual video production, the accurate generation of each person’s movement trajectory, or “trajectory” for short, plays a pivotal role. VVERTIGO has enhanced the generation performance of these trajectories by implementing a graph-based clustering algorithm. This algorithm demonstrates stable performance even when there are many individuals, leading to an increased number of clusters. A notable feature of this algorithm is its ability to perform dynamic clustering without pre-specifying the number of clusters.

To enhance the similarity between data points, VVERTIGO utilised the KBS6700 dataset for feature extractor training. This dataset comprises images of 6,700 celebrities who have appeared on KBS broadcasts, totalling a massive 4 million images. The use of KBS6700 offers a more precise understanding of East Asian facial features compared to the predominantly Western-centric datasets like VGGFace2 [See Qiong Cao et al., “VGGFace2: A Dataset for Recognising Faces across Pose and Age”, 2018 13th IEEE international conference on automatic face & gesture recognition (FG 2018), 2018] and CASIA-WebFace [See Dong Yi et al., “Learning Face Representation from Scratch”, arXiv, 2014].

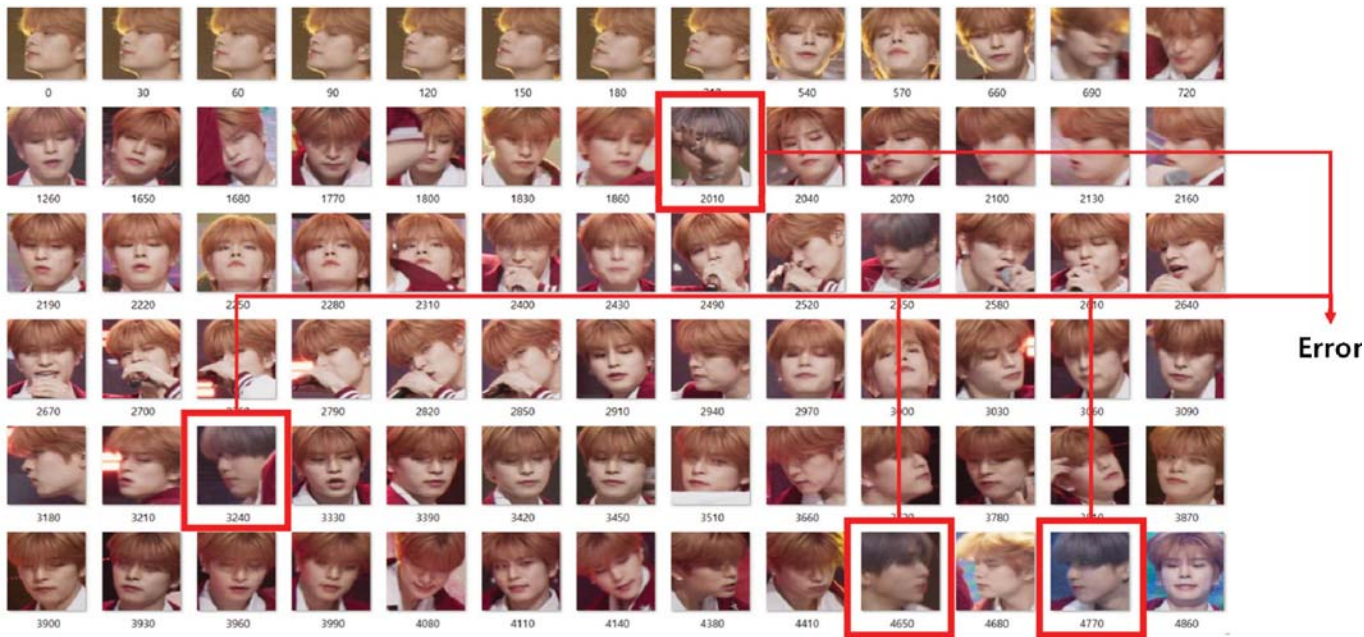


Figure 6. Examples of incorrectly clustered images

Table 2. Comparison of clustering results between KBS6700 and VGGFace2

Target contents	Dataset	#Members	#Cluster	#Top cluster	Error rate
Stray Kids	KBS6700	8	38	2,085	0.24%
Stray Kids	VGGFace2	8	67	1,787	0.72%
Ohmygirl	KBS6700	6	23	1,795	0%
Ohmygirl	VGGFace2	6	26	1,751	0.11%
The Boyz	KBS6700	11	57	2,863	0.45%
The Boyz	VGGFace2	11	100	2,316	2.57%

Table 2 compares the clustering results of feature extractors trained using the KBS6700 and VGGFace2 datasets. Here, #Members represents the number of members, #Cluster indicates the number of clusters generated, #Top cluster denotes the number of images included in the top cluster corresponding to the member count, and Error rate signifies the proportion of misclassified images within a cluster.

In the study, when trained with VGGFace2, an average of 1,977 videos were included in the top clusters. Conversely, when trained with KBS6700, an average of 2,253 videos were incorporated into the top clusters. In terms of average error rate, VGGFace2 achieved a misclassification rate of 1.28%, while KBS6700 achieved 0.27%. Utilising the model trained with KBS6700 yielded 13.9% more trajectory points and reduced the error rate by 1.01%.

2.4 Multi-GPU accelerated parallel rendering

Rendering 8K videos, especially those compressed with high-efficiency codecs like HEVC, can be time-consuming. In scenarios like Fancam production, where videos shot on the same day need to be released immediately, rendering time delays can pose significant challenges. For instance, with KBS Music Bank Fancams, up to 50 Fancams are produced in a single day, and depending on the rendering speed, the production time can vary drastically from 1 hour to 10 hours.

To address this issue, VVERTIGO developed a rendering module based on Nvidia GPUs, rather than relying on conventional software-based rendering. Notably, the feature of accelerating rendering tasks using parallel GPUs is a rarity among commercial NLEs.

Figure 7 presents a comparison of rendering times between VVERTIGO and other commercial NLEs, based on actual 8K performance videos from KBS Music Bank.

• Test Video Details

- Total video length: 3 minutes 03 seconds

- Input: 8K(8192x4320), 60p
- Output: 1920x1080, 60p

• Test Environment

- CPU: Intel(R) Xeon(R) Gold 6226R
- GPU: Nvidia RTX A4000 (Configurations with 1 and 4 GPUs)

• Test Results

- VVERTIGO (4 GPUs): 47 seconds
- VVERTIGO (1 GPU): 2 minutes 47 seconds
- Davinci Resolve: 2 minutes 56 seconds
- Premiere Pro: 3 minutes 46 seconds
- Note: Most commercial NLEs do not support multi-GPU split rendering

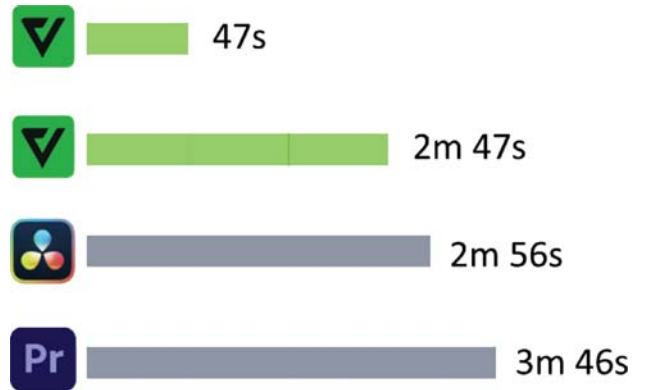


Figure 7. Comparison of rendering speeds for 8K footage

VVERTIGO's Multi-GPU acceleration technology is applied not just in rendering but across the entire process, enabling real-time previews of 8K videos and rapid video transformation tasks. Furthermore, VVERTIGO plans to support acceleration not only on Nvidia GPUs but also on Apple Silicon APs in the future.

3. USE CASES FOR MULTI-CAM PRODUCTION

VVERTIGO has been employed in various broadcast media productions, playing a pivotal role especially in shows like Music Bank and Pyeon's Restaurant. In this section, we will delve into the application of VVERTIGO, focusing on the production cases of these two programmes.



Figure 8. List of programmes using VVERTIGO



Figure 9. Utilising a single 8K camera for music performance

3.1 Music performance fancam

KBS Music Bank offers individual fancams for each performance through the KBS KPOP YouTube channel, where the efficiency of VVERTIGO is remarkable. K-POP artists have varying numbers of members, ranging from 6 to 13. By utilising a single 8K camera and VVERTIGO, the AI-based tracking feature automatically follows the movements of the singers, and GPU-based rendering quickly produces the final output. Given the nature of Music Bank, where filming and broadcasting occur on the same day, VVERTIGO's rapid editing capability allows immediate release of Fancams right after the broadcast.

Since the introduction of VVERTIGO in 2019, Music Bank has produced over 10,000 fancams from approximately 1,500 performances.

3.2 Variety show panel reactions

KBS Fun-staurant is a talk-show format programme consisting of a total of eight panellists. Most of the standard filming angles are produced using VVERTIGO. The panellists are seated at two tables with four members each, and each table is equipped with a single 8K camera. From this one 8K camera, a total of 10 different angles, ranging from solo shots to four-shots, are generated.



Figure 10. Examples of various angles achieved using a single 8K camera and VVERTIGO

These diverse angles offer directors a plethora of visual composition options during the subsequent editing process. Since 2021, Fun-staurant using VVERTIGO has achieved significant cost savings in production by using various angles with only two 8K cameras.

4. CONCLUSION

This study presented a successful application of AI technology in actual broadcast production. The practical application of AI technology faces various limitations when transitioning from the research phase to real-world implementation. Notably, in this study, it was found that publicly available datasets alone were insufficient to achieve the desired AI tracking performance, necessitating the construction of a dedicated training dataset.

Users can be resistant to adopting new technologies due to their inertia with existing workflows. To overcome this, we approached users with the message, "Delegate repetitive tasks to AI and focus on your creative work." This approach proved to be highly effective.

Many broadcasting companies are currently contemplating

the adoption of 8K production. However, the significant costs associated with its implementation make the decision challenging. The reframing method proposed in this study introduces 8K only at the filming stage and maintains the existing method for the rest of the workflow, thereby significantly reducing the cost burden. In particular, the substantial cost-saving effect achieved by reducing the number of cameras provides a strong incentive for the adoption of new technology. VVERTIGO can play a pivotal role during this technological transition.

While this study primarily focused on the application in music performances and variety shows, based on the results, we plan to explore the potential application in other genres such as sports and live commerce. To achieve this, it is necessary to improve AI tracking performance according to the characteristics of each genre. We are aiming to develop a version suitable for real-time live broadcast production by enhancing the speed of AI tracking.

For more information, please visit the VVERTIGO website: <https://www.vvertigo.com>

AUTHORS



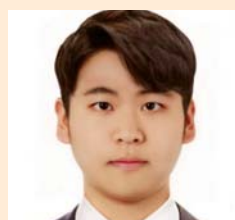
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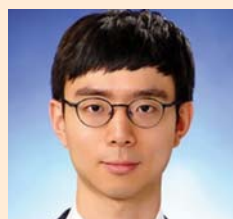
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MDP-BASED DASH IMPROVEMENT USING HIERARCHICAL REINFORCEMENT LEARNING

ABSTRACT

Fast growing rate of video traffic volume in communication links and the interest of mobile phone users to watch multimedia content online, have pushed researchers to design new mechanisms in order to enhance the quality of user experience. Dynamic adaptive streaming over HTTP (DASH) is a widely used video streaming standard. In this video streaming service, the servers save different copies of a video at different bitrates, allowing users to receive different bitrates from a given varying available bandwidth. The main focus of this research is on methods of designing controllers applied to improve a user's quality of experience (QoE) in watching an online video stream based on reinforcement learning at the client side. These controllers are not designed based on a basic system model and its states. Therefore, learning is performed with trial and error. In this research, reinforcement learning is applied to improve the user QoE in a DASH based video streaming environment. The quality parameters of the user experience we are trying to improve, include the average quality of received video, freezing rate during playout, and the rate of variation between the different video qualities. To compare the results of the proposed solution and existing methods, all have been tested for different rewards and penalties. Simulation results show that the proposed scheme outperforms existing solutions.

Keywords

DASH, Q-Learning, MDP, Hierarchical Machines, Video on Demand

I. INTRODUCTION

Recently, due to the emergence of many companies that provide video content and increasing interest of people in watching it online, the traffic of telecommunication networks, especially multimedia content, has increased dramatically. Along with this increase, users' expectations for video quality has increased accordingly, resulting in a lot of challenges in designing multimedia streaming protocols and algorithms. For example, we can mention topics like, how to use network protocols to send video content, how to reduce the delay of sending video packets, provide an uninterrupted stream and choose the appropriate bitrate for video content.

In past research, various adaptive streaming solutions have been proposed to dynamically select the appropriate bitrate for video content based on the state of the network, to provide an acceptable high quality streaming service. Given that the HTTP service has great scalability advantages, it is currently considered as a universal platform for delivering video content. Dynamic adaptive streaming over HTTP (DASH) is an international standard for the transmission of video content, which was developed in 2011 by the Moving Picture Experts Group (MPEG). DASH is a technique that dynamically determines the requested video bitrate on the client side to be asked from the server.

DASH system architecture is shown in **Figure 1**. Based on this architecture the video is initially divided into small parts called chunks on the server side, and each of these chunks can be displayed at different quality levels. Information about the different quality levels available on the server is

given to the client by the Media Presentation Description (MPD) file. When a client sends an HTTP-request message to the server, the server sends the MPD file to the client. Then, the client sends an HTTP-get message to request the chunk with the desired bitrate. This process continues until the completion of all video chunks.

The Reinforcement Learning (RL) method is an effective solution for choosing the quality of video parts in the DASH system. In this method, instead of relying on fixed control rules, agents can try different actions and gradually learn the best strategy for each state. This is achieved by trial and error, which reinforces the system's performance for efficient behaviour with a reward function. RL has been used in several applications and, if properly parameterised, can be very efficient after a short training period. However, research on RL applications for the DASH system is still ongoing [3].

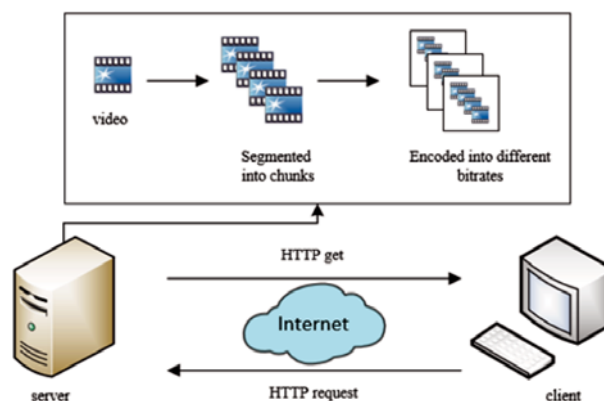


Figure 1 : DASH system architecture

As mentioned, in the DASH system architecture the bitrate is determined dynamically on the client side. For this purpose, choosing the quality of each chunk of the video should lead to providing high quality with an acceptable level of buffer [4]. Using the RL method, the optimal policy can be learned by experience, even if the future trend of the channel rate is unknown. The optimal policy tries to satisfy the expectations of the reward function, and since it can re-evaluate its choices for each chunk, it never deviates from the correct path.

Flat Q-Learning Algorithm

- 1: Initialize Q to zero
 - 2: Download the first chunk using the lowest quality and observe next state
 - 3: REPEAT
 - 4: Update Q
 - 5: Calculate Boltzmann probability and use it to select quality q of next chunk
 - 6: Download the next chunk using quality q and observe next state
 - 7: CONTINUE
-

This research is based on the method presented in [2], which can be used for online optimisation of the bitrate and does not require initial training. The main modification is that the buffer level is divided into three areas with low risk, medium risk, and high risk according to the available time until it is empty, thus creating three working environments for the system. The agent can learn these three environments separately and has the ability to change its working environment. The proposed algorithm has been tested in several different scenarios. Simulation results show that the efficiency of the proposed scheme is higher and its compatibility with DASH is superior compared to other existing methods. The problem of determining video bitrate with the RL technique is a Markov decision process. This Markov model is considered with the QoE improvement approach. The proposed method uses Q-learning [5] algorithm to learn and update the system.

The remainder of this paper is structured as follows. We discuss related work in Section II. Section III shows the basics of using reinforcement learning in the DASH system. The proposed algorithm is presented in Section IV and the results of its simulation are presented in Section V. We conclude the paper in Section VI.

II. RELATED WORKS

There are generally four schemes, depending on where the bitrate decider is located on the network: client-based, server-based, network-assisted, and hybrid [6]. Most of the proposed adaptive video streaming schemes, which are based on DASH standard, are client-based [7]. In the following, only the client-based schemes will be introduced. These methods try to adapt to bandwidth changes by changing the appropriate video bitrate according to one or more criteria such as available bandwidth and playback buffer size.

Adaptive video streaming methods in another category are generally divided into model-based and learning-

based methods. Model-based methods are developed by fixed control rules that make decisions related to bitrate selection, hence they may not be generalisable to different network conditions. In contrast, learning-based methods automatically learn how to make bitrate decisions and operate without using any pre-programmed control rules or explicit assumptions about the environment [8]. Most learning-based methods use reinforcement learning techniques to learn a control policy to determine the bitrate, purely through experience. In the following, we will discuss some learning-based methods.

Bokani et al. [2] proposed an HTTP-based adaptive streaming method in vehicular environment using the Markov decision process (MDP). This method is based on learning and uses the Q-Learning algorithm to obtain its decision policy. This algorithm does not need to know the bandwidth model of the network. The System state is determined when a chunk is completely downloaded. The state of the system is jointly determined by the quality level of the previous chunk and the amount of time available until the buffer level is empty. Decision-making or action is choosing the quality level for the next chunk. The reward is also a function of the quality criteria of the user experience, these three criteria are the quality level of the requested chunk, the degree of quality level change, and video freezing. The probability of selecting each action in each step is calculated by the Boltzmann distribution function. The pseudocode of this method is given in the following algorithm.

Mao et al. [8] designed neural adaptive video streaming with Pensieve that produces ABR algorithms using reinforcement learning. Pensieve trains a neural network model that selects the bitrate for future video chunks based on observations collected by the client's video players. Pensieve does not rely on pre-programmed models or assumptions about the environment and makes ABR decisions based solely on the results of previous decisions, thereby automatically learning ABR algorithms that are compatible with a wide variety of environments and QoE metrics. Pensieve considers its control policy as a neural network that feeds raw observations such as throughput, playback buffer occupancy, and video chunk size into a bitrate decision for the next chunk.

Gadaleta et al. [4] proposed a deep Q-Learning framework for DASH (D-DASH) video streaming to improve the accuracy and speed of bitrate determination decisions. D-DASH combines deep learning and reinforcement learning algorithms to increase the QoE and while trying to achieve an optimal decision policy, it also tries to improve the convergence speed of learning. Specifically, it uses hybrid learning architectures including feedforward and recurrent deep neural networks with advanced strategies. The fast convergence of this method shortens the training phase and makes D-DASH a good candidate for client-side runtime learning.

Claeys et al. [9] proposed a frequency-adjusted Q-Learning (FAQ-learning) approach based on HTTP. This algorithm is proposed to solve the problem of response to sudden changes in the environment using Q-Learning. When

the Q value of an action for a specific state is much less than another action, the probability of selection of this is very low. Therefore, information about it is obtained very slowly. To solve this problem in the FAQ-learning algorithm, when an action has a small selection probability, the corresponding learning rate becomes larger. By doing this, learning is done faster with a low action probability.

As mentioned earlier, the method that will be proposed in this paper is a learning-based method that uses reinforcement learning based on MDP. The MDP formulation we used in this paper is closest to the ones reported in [2] which will be discussed in the next section.

III. REINFORCEMENT LEARNING IN DASH

To introduce the proposed method, in the next section, it is necessary to define and explain the following concepts in this section.

A. MDP based Reinforcement learning

Reinforcement learning is an example of machine learning where the agent does not have a model of the environment and the effects of its actions, but gradually learns how to maximize rewards by using different actions and making mistakes. The basic mechanism in RL is trial and error. **Figure 2** shows a model of reinforcement learning at discrete time points. The agent interacts with the environment through perceptions and actions. Agent perceptions can be in two forms, rewards and states.

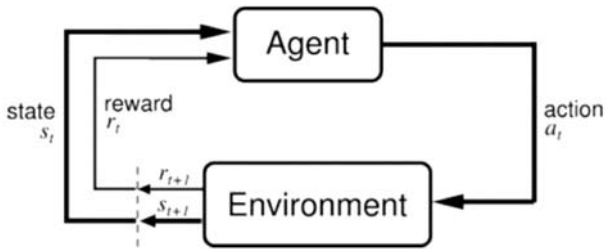


Figure 2 : Basic concept of reinforcement learning [1]

The surrounding environment is observed by the agent in the form of state s_t at time point t , and based on this observation, one of the possible actions of a_t is selected at that time point. This choice of action is observed by the environment and its state changes to s_{t+1} , and a reward signal r_t is also applied to the agent so that the agent makes his next choice according to the new state and previous reward.

RL can be considered as a Markov decision process problem with a tuple $(S, A_s, P_Q(s_t, s_{t+1}), R_Q(s_t, s_{t+1}), \gamma)$, where S represents the set of states, A_s is a set of actions that the agent can perform in the state of $s \in S$, $P_Q(s_t, s_{t+1})$ is the probability of transition from state s_t to state s_{t+1} when the agent performs action α , $R_Q(s_t, s_{t+1})$ is the immediate reward coming from taking action α and transitioning from state s_t to state s_{t+1} and γ is a discount factor for future rewards to avoid divergence, its value should be in the range $[0, 1)$. In the next subsection, we discuss how to formulate MDP in DASH.

B. MDP formulation in DASH

To adapt the bitrate in the DASH system, the concept of reinforcement learning based on MDP can be used. For

example, we can refer to the method presented in [2], which is also the main reference for the activities carried out in this research. In this section, the different parts of the reinforcement learning system that are considered in an adaptive video streaming system will be introduced.

Since the reward function is the basic guide for the RL agent to learn the desired policy, the reward function of the DASH system implemented with this method should represent QoE [10]. In the DASH system presented in [2] for the allocation of rewards and punishments, the quality criteria of the user experience are measured and according to the measurement results, and the priority of each of the three dimensions of QoE, the rewards or punishments of the system are determined. The QoE measures here are the quality level of the requested video chunk, the amount of change in video quality level, and the video freezing caused by buffer emptying. Equation (1) shows the dependence of the total reward of the system using these three parameters.

$$R = R_{quality} + R_{switches} + R_{freeze} \quad (1)$$

The learning environment is affected by channel bandwidths that are out of the direct control of the client. The state of the system is determined by the quality level of the last chunk received and the buffer level at the moment of decision.

The action of the system used in DASH is to select the quality level of the next chunk.

C. Q-Learning

Q-Learning is a reinforcement learning technique designed by Watkins [5]. Q-Learning technique is a well-known algorithm for solving the MDP problem. By learning an action/reward function, Q-Learning follows a specified policy to perform different actions in different states. One of the strengths of this method is the ability to learn the mentioned function without having a specific model of the environment. This algorithm maintains a table of long-term rewards, or Q values, for all possible pairs (state, action), and gradually improves its estimates based on experience. The problem model consists of an agent, a set of states S , and a set of actions A_s for each state. By doing an action, the agent goes from one state to the next state and gets a reward based on the action and the next state. The goal of the agent is to maximize the total reward received. This goal is achieved by learning the optimal action for each state. The algorithm has a function that calculates a specific real value as a reward for each state/action combination.

The Q-learning update formula is given in equation (2). The formula ensures that the Q values eventually reach the true long-term reward [5]:

$$Q: S \times A \rightarrow R$$

$$Q_t(s, a) = (1 - \alpha)Q_{t-1}(s, a) + \alpha[R(s, a, s') + \gamma \max_{a'} Q(s', a')]$$

(2)

Where $R(s, \alpha, s')$ is the reward of going from state s to state s' by doing action α , which is given to the agent. α is the learning rate, which is $0 < \alpha \leq 1$. This rate determines how much newly acquired information is preferred over old information. A value of zero makes the agent learn nothing, and a value of one makes the agent only measure new information. The discount factor γ determines the importance of future rewards. A value of zero makes the agent take an opportunistic nature and consider only current rewards; While a value between zero and one prompts the agent to increase the total rewards of the update time due to the foresight created in the Q relation. If the value of γ is one or more than one, the values of Q diverge.

In reinforcement learning, exploitation means using previous learning to select system actions, and exploration means choosing random actions to discover new information. The detection algorithm used in this article is Softmax.

Softmax is a policy that is explicitly related to the discovery problem [11]. This policy works by converting the expected reward of each action into a probability and selecting the action based on the resulting distribution, which is set in the form of the following formula:

$$f(s, \alpha) = \frac{e^{\frac{Q(s, \alpha)}{\theta}}}{\sum_j e^{\frac{Q(s, \alpha)}{\theta}}} \quad (3)$$

The value of $f(s, \alpha)$ in equation (3) indicates the probability of choosing action α when the system is in state s . The parameter θ , commonly referred to as the heuristic temperature or temperature, can be adjusted to control the amount of heuristic. In fact, the value of θ regulates the degree of randomness of the choices. In this policy, actions with high $Q(s, \alpha)$ have a higher probability of being selected. In this relation, J represents the number of actions that can be selected in the state s .

D. QoE objective measurement model

In this paper, QoE will be measured with the MOS scale [9]. By combining the quality level, its changes and the aspect of video freezing, the estimated MOS for displaying a DASH video consisting of K segments, which plays segment k at quality level QL_k , is calculated using equation (5). In this relationship, the average quality level and its standard deviation are calculated as $\mu = \sum_{k=1}^K QL_k / K$ and $\sigma = \sqrt{\sum_{k=1}^K (QL_k - \mu)^2 / K}$, respectively.

$$\phi = \frac{7}{8} \times \max\left(\frac{\ln(F_{req})}{6} + 1, 0\right) + \frac{1}{8} \times \left(\frac{\min(F_{avg}, 15)}{15}\right) \quad (4)$$

$$MOS_{est} = \max(0.81 \times \mu - 0.96 \times \sigma - 4.95 \times \phi + 0.17, 0) \quad (5)$$

IV. PROPOSED ALGORITHM

In the DASH system implemented with the reinforcement learning method, an agent interacts with an unknown environment. The decision-making problem of this system can be considered a Markov decision process, and research in this field can be done for the approximate solution of

MDP, according to the environment and agent parameters. The previous MDP algorithms that were implemented in the DASH system considered the state space as a unified and flat search space. This can be suitable in many domains where the state space is smaller. However, if the reinforcement learning used includes more states, it becomes more difficult to find the optimal policy. In this paper, by creating a hierarchy of separate tasks, and by creating abstraction and sharing mechanisms, this problem has been tried to improve to some extent. This has been implemented using hierarchical reinforcement learning.

In the proposed method of this paper, the buffer level in the DASH system is divided into three areas: green, yellow, and red. **Figure 3** shows the area of the system at different buffer levels. In the green area, the player has more time until the buffer is empty and chooses high qualities for downloading. In red state, the system requests low qualities because the buffer level is low and there is a risk of buffer emptying and video freezing. In the yellow state, the system is allowed to choose intermediate qualities. Therefore, in the proposed system, it is not possible to download high qualities at the low buffer level, because it increases the possibility of emptying the buffer. By doing this, the number of qualities that can be selected in all three buffer conditions will be more limited and the random selections of the system will be more suitable to maintain the high average quality and the minimum number and time of emptying the buffer, and this issue is also one of the advantages of the proposed method because high quality jumps cause user dissatisfaction and lower QoE.

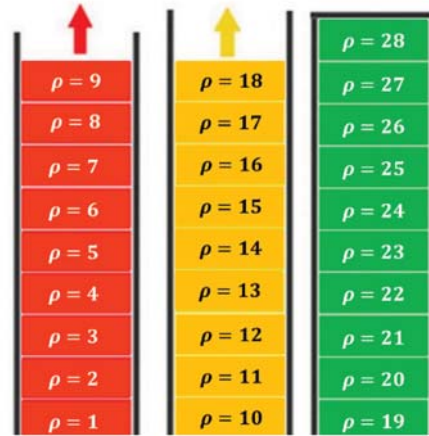


Figure 3 : Buffer levels in the proposed method

The buffer level in DASH systems implemented with the MDP method is one of the parameters indicating the state of the system, so the idea of dividing the buffer level into three states, green, yellow, and red, and applying different policies in each state, using the concept of hierarchical reinforcement learning, can be implemented. In this type of learning, the overall task of the system is divided into several simpler and more detailed subtasks, and its overall goal is to discover and exploit the hierarchical structure in an MDP problem. In this method, at the end of learning, each subtask has its optimal policy, and the overall MDP policy will be a combination of the policies of all subtasks. In this paper, the method used to learn each subtask is the Q-Learning algorithm.

In this paper, we use a hierarchical semi-Markov Q-Learning (HSMQ) algorithm to solve the MDP problem, in which each sub-task p learns its own Q table. Each value of this table is stored in the form of $Q(p, s, \alpha)$, which shows the total amount of reward expected from the execution of sub-task p with initial state s and action α . The pseudocode of the HSMQ algorithm is shown in the following algorithm.

```

HSMQ Algorithm

function HSMQ(state  $s$ , subtask  $p$ ) returns float
  Let  $TotalReward = 0$ 
  while  $p$  is not terminated do
    Choose action  $a = \pi_x(s)$  according to exploration policy  $\pi_x$ 
    Execute  $a$ .
    if  $a$  is primitive, Observe one-step reward  $r$ 
    else  $r := HSMQ(s, a)$ , which invokes subroutine  $a$  and
      returns the total reward received while  $a$  executed.
     $TotalReward := TotalReward + r$ 
    Observe resulting state  $s'$ 
    Update  $Q(p, s, a) := (1 - \alpha)Q(p, s, a) + \alpha [r + \max_{a'} Q(p, s', a')]$ 
  end // while
  return  $TotalReward$ 
end
  
```

Figure 4 shows an example of changing the states of the proposed system by performing different actions and switching between environments. (p, q) represents the state of the system and each house of the tables shows a system state, where the horizontal axis shows the quality of the last loaded chunk q and the vertical axis shows the buffer level p . In the red area, the system is only allowed to choose the quality level 1 and 2, therefore the end of the vectors whose beginning is in the red area goes to the houses whose q is 1 or 2. In the yellow area, the system is allowed to choose the quality level 3 and 4, and in the green area, the system is allowed to choose the quality level 4 and 5. For example, the third vector shows that when the system is in (8,2) state and chooses quality 2 for the next chunk, it goes to (12,2) state by performing this action. As a result of this action, the buffer level is increased and the system goes from the red area to the yellow area. In the Q matrix, to update the value of (2,12,2), we use the sum of the rewards and penalties that the system has received from the time of entering the yellow environment until the time of leaving, that is, from the third to the fifth action.

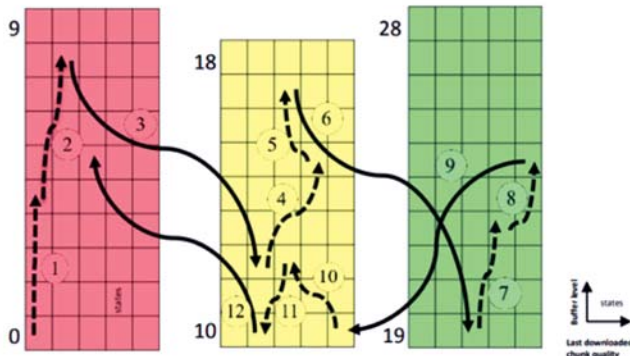


Figure 4 : An example of changing states in the proposed system

V. SIMULATION AND RESULTS

In this section, first, the simulation parameters of the proposed method are introduced, and then the simulation results and their comparison with other methods are presented.

A. Simulation parameters

Here we first introduce bandwidth and video clips used in the system and then some of the main parameter values will be given.

Experiments have been performed on the mobile broadband data set collected by Yao et al. [12] in the real world. This data set is the available bandwidth of the mobile input while driving on a route in the city of Sydney, Australia, which was sampled approximately once every 10 seconds.

The simulations are done on the Big Buck Bunny video clip as done in [2]. The duration of the original clip is only 9:56 minutes, but the playback of the video in the test environment has been repeated several times. For this experiment, five versions of the video with different qualities were created. FFMPEG software is used to encode the original video file at bitrates of 186 kbps (quality 1), 499 kbps (quality 2), 1101 kbps (quality 3), 1292 kbps (quality 4), and 1898 kbps (quality 5). Each video stream is multiplexed with a 128 kbps audio file to create an MPEG-2 video stream. The resulting video file is divided into two-second chunks. The average and variance of the size of the chunks have been calculated for each video quality. Since the variance of the size of the chunks is small, the average size of the chunks is used instead of their exact size in the simulations for all video chunks. Some of the main parameters used in this experiment are summarized in TABLE I.

TABLE I : PENALTY FOR QUALITY CHANGE [2]

Switch (q_1, q_2)	1	2	3	4	5
1	0	1	5	10	25
2	10	0	1	5	10
3	50	10	0	1	5
4	250	50	10	0	1
5	500	250	50	10	0

1) States of system

When a chunk of video is fully downloaded, the system status is visible. The state of the system (p, q) is determined by the amount of time available before the buffer runs out (p) and the quality level of the last downloaded chunk (q). If, after storing the downloaded chunks, there is not enough space in the buffer for another chunk, the decision to restart the download of subsequent chunks will be postponed until there is enough space in the buffer to load another chunk. This behaviour prevents buffer overflow. The upper bound for the value of p is essentially controlled by the size of the buffer. For example, if we have a buffer with the capacity to hold 7 video clips and the time of each one is 2 seconds, the upper bound for p is 14 seconds.

Given that p is a discrete number between zero and an upper limit, a discrete system is used to achieve a finite number of MDP states. In the system discussed in this paper, similar to the method applied in [2], every second is divided into n intervals and an integer is used to represent the value of p . For example, in a buffer with a capacity of 7 chunks of 2 seconds, if $n = 2$, we will have $7 \times 2 \times 2 =$

28 different values for p . It is clear that for high values of n , the state space becomes larger and more time is required to solve the MDP.

2) Actions of system

In any state, the decision made is called an action. For the DASH system, a fundamental decision is to decide on the level of quality for the next chunk. If we have N quality levels to choose from, the number of possible actions is N . Each action will lead to the next loading with the given time and probability function and so on to a new value for p . It is clear that an action chosen in the current state also affects the probability of reaching a specific state in the next stage.

3) Reward function

The reward function used is similar to the reward function of [2]. The reward function $R^q(i, x)$ evaluates the performance of the action q in state $s(i, x)$ using some rewards and penalties:

$$R^q(i, x) = u(q) - d(i, q) - c(x, q) \quad (6)$$

Where $u(q)$ is the reward for seeing a chunk in quality q , $d(i, q)$ is a penalty for emptying the buffer and $c(x, q)$ is a penalty for changing the quality level from x to q . As explained in the previous sections, MDP is a flexible optimization framework whose result can be changed by adjusting its reward and penalty parameters and prioritizing each of the three dimensions of streaming performance, i.e., image quality, quality change, and video freezing. In simulations, the quality reward parameter has been kept constant according to **TABLE II**; But the penalty of emptying the buffer (D) and changing the quality (C) is variable. The value of C changes as a coefficient of the values presented in **TABLE III**. $u(q) = u(q) \times 10$ used to encourage the system to load high qualities.

TABLE II : MAIN MDP PARAMETERS [2]

number of saved qualities of the original video on the server	$N = 5$
capacity of the player's buffer in terms of two-second chunks	$M = 7$
number of short time intervals per second	$n = 2$
discount factor for future rewards	$\gamma = 0.9$
system learning rate	$\alpha = 0.9$
boltzmann exploration temperature	$\theta = 0.9$

TABLE III : REWARD FUNCTION [2]

Quality level (q)	1	2	3	4	5
$u(q)$	1	2	4	7	10

B. Results

In this section, a scatter plot of deadline miss (DM) and average chunk quality (AQ) data will be shown for the proposed method, and then a comparison will be made between the proposed method and existing ones. The data is obtained from repeated video streaming and averaging of the performance of sessions 66 to 71.

Figure 5 is the scatter plot of AQ and DM data obtained from different combinations of deadline penalty (D) and

quality change penalty (C) values. The diameter of the circles indicates number of times quality was changed (QC). It can be seen that for a certain AQ, a trade-off can be made between DM and QC. For example, you can see AQ values between 4.5 and 4.7. In this interval, there is a different DM for the same AQ, but a smaller DM is obtained with a larger QC. We also notice that MDP establishes a non-linear trade-off between video quality and image freezing, and if you try to watch a video with high quality, the number of images freezing increases. In the following, this trade-off will be used to compare the proposed method and previous methods. One method is better than another if it establishes a better trade-off, i.e., it has a lower DM for the same AQ or a higher AQ for the same DM.

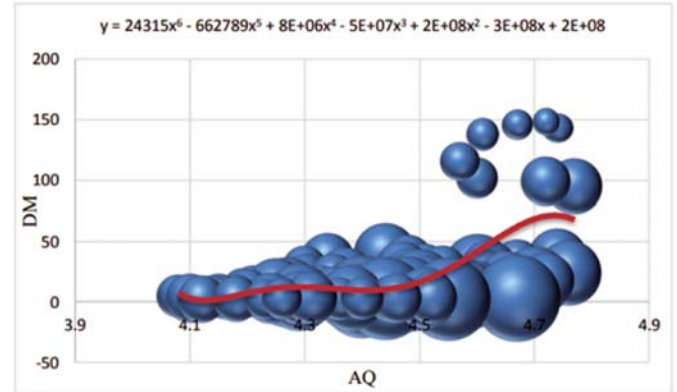


Figure 5 : scatter plot of AQ and DM

Figure 6 compares the scatter plot of the proposed method with the scatter plot of Bokani et al. [2] method. In the diagram, Bokani et al.'s method is indicated by the name of flat Q-Learning algorithm. As it is clear, the proposed method has established a better trade-off between DM and QC, on the other hand, for an assumed quality, the number of image freezing is less in the proposed method.

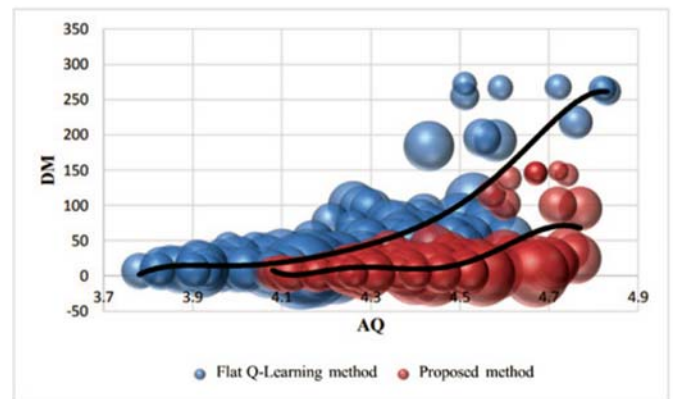


Figure 6 : Comparison of the scatterplot of the proposed method and flat Q-Learning method

As mentioned in Section III, the proposed algorithm determines the probability of choosing of its actions based on the Boltzmann function. In this way, actions that have more rewards will be more likely to be chosen. **Figure 7** and **Figure 8** compare AQ and DM of the proposed method with flat Q-Learning algorithm and an algorithm with a random selector that always makes its decisions with equal probabilities, i.e., 0.2. These diagrams are drawn for 70 episode of video playback, where $\theta = 15$.

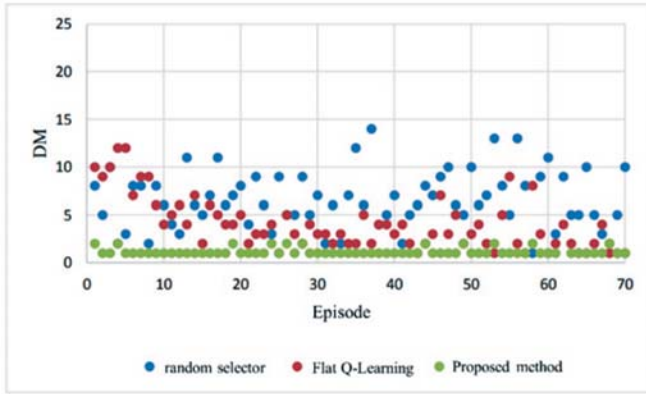


Figure 7 : AQ comparison of the proposed method with flat Q-Learning and a random selector

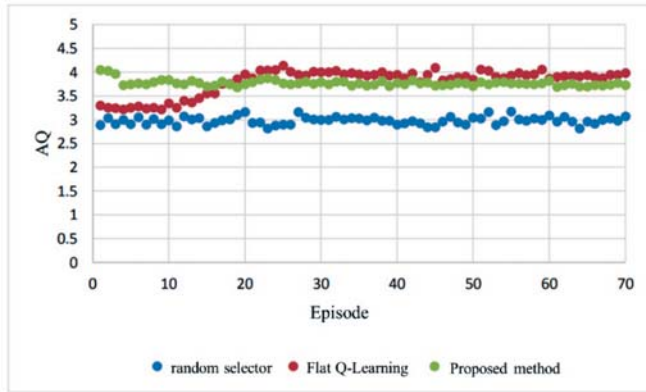


Figure 8 : DM comparison of the proposed method with flat Q-Learning and a random selector

In Section III, an objective model for QoE measurement resulting from video streaming was introduced. In **Figure 9**, the QoE diagram is drawn 100 times of playing the video. It can be seen that with the increasing experience of the system, the QoE improves. Even in the initial stages of streaming, it performs better than other methods, which can be because that by using the hierarchical structure, random selections of the system are more limited, and even though the lack of experience of the system cannot take very harmful actions.

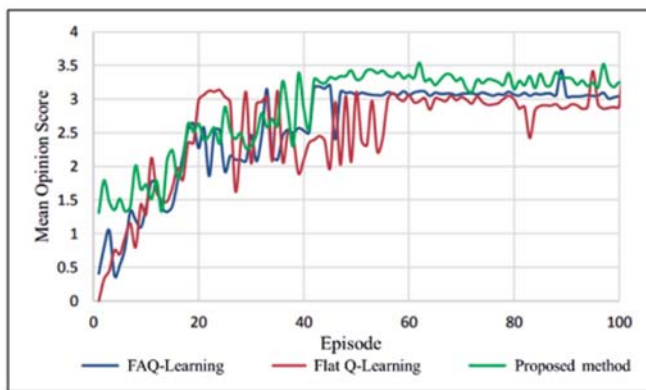


Figure 9 : QoE comparison of the presented method with previous methods

VI. CONCLUSION

In this paper, the DASH system was implemented using reinforcement learning, which measures QoE criteria to assign rewards and penalties. The QoE criteria include the quality of the requested video chunk, the amount of change in the video quality level, and the freezing of the video caused by emptying the buffer. Using reinforcement learning instead of a fixed algorithm makes the system try

different choices and gradually learn the best strategy for each situation.

In the proposed method, it has been attempted to increase the QoE by making changes to the method of Bokani et al. [2]. For this purpose, the concept of hierarchical reinforcement learning has been used, which causes system tasks to be divided into several sub-tasks, and ultimately leads to better learning and a better system performance. In this method, the buffer level is divided into three areas and the system selections in each situation are limited compared to the existing methods. This limitation in choice protects the system from risky choices. For example, when the buffer is at low levels, choosing high qualities will empty the buffer, or when it is at high levels, choosing low quality will decrease the average quality. In the proposed method, this problem has been solved to some extent. Of course, the effectiveness of the proposed method becomes more apparent with the increase of the system state space. The simulation performance shows that the proposed method remarkably outperforms previous methods, by reducing the video freeze rate for similar average quality, which ultimately increases the QoE.

Apart from applying the concept of hierarchical machines, many other features of video content can be studied and used to optimize QoE in future work. Some of these cases include examining the video content and determining the appropriate bitrate along with reinforcement learning, how to initialize the Q matrix, the effect of the duration of the video parts, and studying the learning rate of the system.

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Sales Director, Telstra Enterprise International

From Digitisation till Monetisation – 22 June 2023, Thursday

It is internationally acknowledged by archive bodies that the year 2025 is the deadline for all forms of analogue AV legacy content to be digitised. Failure to do so may result in the content being permanently undigitised. To establish a successful legacy content digitisation ecosystem within the client's environment, the media industry requires the following:

- Curate and carry out interventive conservation on existing archives content.
- Harvest, enrich, and migrate the related technical and descriptive metadata to the chosen archiving platform.
- Address and overcome digitisation and restoration challenges.
- Re-purpose such outputs to a myriad of delivery packages.

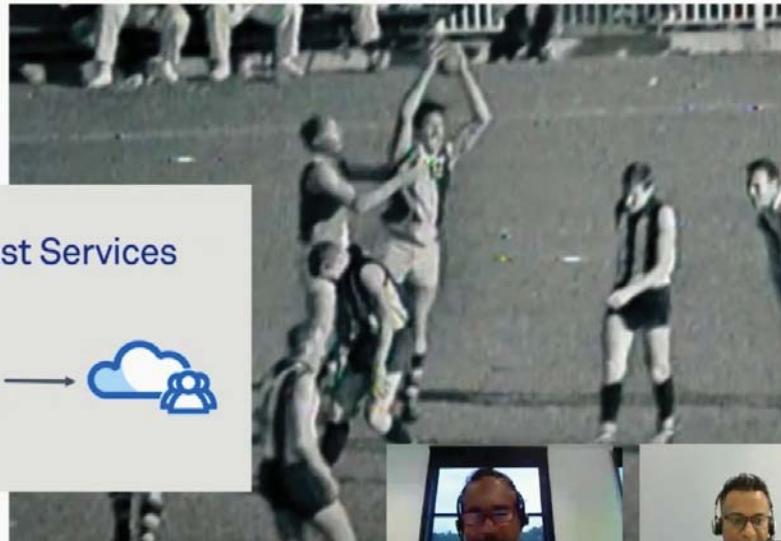
For a media asset management (MAM) system to not only automate the archiving workflows but also track manpower and processes, it must carry a comprehensive data model in associating analogue and digital assets with their related metadata. The path to carrying out all processes of digitisation, restoration, and content preparation with security and compliance involves several challenges. To establish a successful legacy content digitisation ecosystem within the client's environment, the media industry requires the following:

- Carry out all processes of digitisation, restoration, and content preparation while ensuring security and

compliance.

- Architect archival infrastructure and workflows into the existing environment with the help of a knowledgeable system integrator (SI).
- Handle very high capacity ingest to efficiently manage large volumes of data.
- Demonstrate a proven track record in successfully handling the digitisation of national audiovisual (AV) projects.
- Maintain a reserve of legacy playback devices and knowledgeable manpower capable of digitising AV content from various formats, including but not limited to ¼", ½", 1", Umatic, Analogue & Digital Betacam SP, DVcam, mini DV, etc.
- Collect and report information on tape conditions and treatments, such as cleaning, baking, and repairs.
- Maintain tight control over collection management, file naming, and client reporting by utilising client barcodes to drive highly automated workflows.
- Ensure flexibility in digitisation and encoding parameters, including codecs, containers, up-conversions, transcoding of proxies, etc.
- Integrate with automated file-based quality control (QC) and manual QC processes to ensure the quality of digitised content.
- Handle data migration from and to all known platforms to facilitate seamless transitions.
- Provide online access to browsing and viewing proxies

• Kicking Cloud Goals



Telstra Broadcast Services



of high-quality AV masters with multi-tenanted rights assignment for the client.

- Offer secure online pre-approvals of digitised content to progress with subsequent processes such as restoration and up-conversion.
- Deliver client notifications via emails and short messaging services at client-defined stages of the production processes.

These requirements are essential for establishing a successful legacy content digitisation ecosystem within the client's environment. They help ensure the preservation, accessibility, and efficient management of media assets. The solutions provided in the DAMsmart workflow include: Physical assets preparation & digitisation, Interventive physical restoration of tapes, Gear to physically restore

deteriorated films, Support of various tape formats and digital restoration. Digital Restoration encompasses the restoration of digitised content, addressing inherent tape/film artifacts. The content is digitised, restored, graded, upscaled, and AR converted.

The Content Preparation processes include: Content assessment, Transcoding to various digital deliverables, Subtitling, Audio dubbing, Content packaging and Quality Control, to ensure the quality of the digitised content.

Futurestor, established in 2022 by media and entertainment veterans, is a platform that aims to revolutionise content storage, distribution, and monetisation using Web3 and blockchain technologies. Recognising the maturation of blockchain technology, Futurestor envisions the future

SUMMARY

- One-stop shop from digitisation through to WEB3 design and layout
- Archive Monetisation
- Transact directly with the consumer
- Massive cost saving by reduction in the supply chain
 - Reinvest into your archive
- Easy to use wallet setup and payment gateway
 - Access wallet and keys with own email or Google ID and pay with a regular credit or debit card
- No need for prior experience with crypto in order to enjoy these new entertainment offerings
- New direct relationship between content owners and fans, allowing the fan to be a direct owner of the experience and trade into that with other fans
- B2B or B2C
- Benefits not only independent content creators but also larger legacy media companies



- Media & Broadcast Solutions
- from Media Experts



TV
Broadcasters



Satellite
Operators



Service
Providers

Telstra Broadcast Services



Sports &
Wagering



Content Creators



OTT Providers



foundation of media distribution and monetisation. It offers a one-stop Web3 entertainment ecosystem that facilitates organic user engagement and promotion. It provides a comprehensive monetisation ecosystem, elevating content ownership, distribution, and user experience to the next level. With Futurestor, content creators can explore blockchain media opportunities for direct monetisation, benefit from hyper-efficient content preparation, and ensure legal content distribution. Futurestor wraps itself around the services of DAMsmart, Silver Trak Digital and Eluvio with the backing of Telstra.

The speakers from Telstra and DAMsmart demonstrated a typical workflow and its products & services along with a highly secure cloud-based collaboration & content delivery

platform and archiving workflows. Telstra International has connected the world for over 70 years with media & broadcast solutions for TV broadcasters, satellite operators, service providers, sports & content creators and OTT providers. Telstra broadcast services and DAMsmart collaborate for end-to-end archive content supply chain & management on cloud platforms.

The session was jointly presented by **Nathan**, Vice President of Sales (Asia) from DAMsmart & Silver Trak Digital, and by **Rueben Thomas**, Sales Director of Telstra. Close to 105 participants attended the webinar. They spanned 25 countries from the Asia-Pacific and elsewhere representing about 51 organisations.

ABU Technology Webinar

The
Speaker

KBS Exhibition Features and Highlights at the KOBA 2023 Show

***Jeongseob Kim** received his B.E degree in electrical and electronic engineering from Yonsei University. He joined KBS in 2012, and spent 7 years as a production engineer in the Outside Broadcasting Department, and is currently working as a KOBA exhibition coordinator in the Technical Administration Office.*



Jeongseob Kim
KOBA exhibition
coordinator,
KBS-Korea

KBS Exhibition Features and Highlights at the KOBA2023 Show – 22 June 2023, Thursday

ABU Technology organised another webinar session on 22 June 2023 as a part of the member innovations series. **Kim Jeongseob**, KOBA exhibition coordinator from Korean Broadcasting System, discussed different KBS activities at the KOBA2023 Show in the presentation that included AI - based production and mobile platform camera system, UHD Multi - channel services, interactive XR systems, development of 5G and broadcasting networks. About 105 participants attended the webinar, from 25 countries in the ABU region and elsewhere.

The 31st Korea International Broadcasting, Media, Audio & Lighting Show was held from 16th to 19th May, 2023 at the COEX Exhibition Centre in Seoul, Korea. With

the slogan “NEXT STAGE - BREAK THE FRAME”, The exhibition featured two main halls: the Pro-Audio & Pro-Lighting Equipment Zone and the Broadcast & Video Equipment Zone. Over the course of four days, the event attracted approximately 40,770 visitors.

The World Media Forum on Beyond Baseband Beyond Broadcasting featured sessions on the future of the broadcasting industry, including discussions on the present and future of broadcast production with cloud services, key technologies and strategies for content delivery and streaming, as well as content storage and utilisation. The forum also hosted a panel discussion on changes and predictions in the IT-based broadcasting

3. KOBA Media Conference Day-1

Next Stage?
Break the Frame!

2023
KOBA

Topics	Contents
Media Trends	- FAST, OTT and the future of broadcast - Social documentaries meet OTT
Advertising Monetization	- Streaming Success : Grow Your Audience to Grow Your Business and Increase Revenue
IP Broadcast Infrastructure	- The present and future of IP-based UHD production control room systems - Building an IP-based national distribution network
Lighting Trends	- Painting Emotion with Light - Safety in a Japanese TV studio
AI Trends	- ChatGPT and Generative AI will change the way you think - How giant language models and generative AI work
AI and Media	- The technologies being developed now to reduce the time and cost of localizing broadcast content - AI Music Bank Creation / AI color restoration workflow
Media Cloud	- How Global Media Customers Transform with AWS Cloud Media Services - Grass Valley AMPP Live Production Cloud Solution

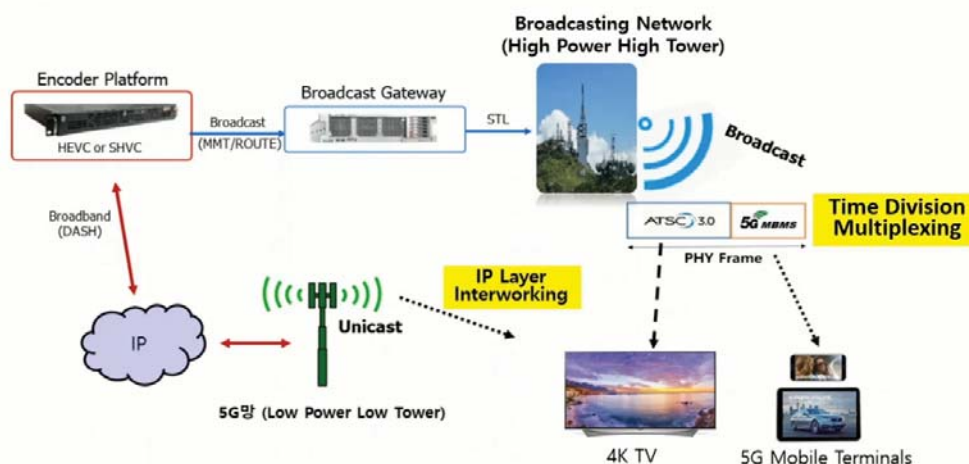


5-4. 5G & ATSC 3.0 interworking transmission

Next Stage?
Break the Frame!

2023
KOBA

- Simultaneously transmits a channel for **fixed reception(ATSC 3.0 standard)** and **mobile reception(5G-FeMBMS standard)** in the form of time division multiplexing within a terrestrial UHD broadcasting channel.



service environment.

Day-1 of the KOBA Media Conference focused on media trends, advertising monetisation, IP broadcast infrastructure, lighting trends, AI trends, AI and media, and media cloud. On Day-2, the conference covered topics such as RTK & audio strategy, video transmission, terrestrial UHD innovation service, XR trends, satellite communications, and IT/IP solutions. The exhibition showcased various technologies and solutions, including XR systems and production solutions.

At the KBS booth, notable highlights included the AI colour restoration tool, an AI tracking camera system, 4 UHD channels using ATSC 3.0 MIMO, 5G & ATSC 3.0 interworking transmission, mobile platform camera

system, interactive XR system, and binaural 3D audio. Channel bonding doubles the transmission rate by bundling two terrestrial broadcast channels with one transmitter using an existing horizontally polarised transmitting antenna. Likewise, the transmission rate was doubled by developing MIMO technology that allows one transmitter to transmit through one dual-polarised (horizontal/vertical) antenna. KBS simultaneously transmits a channel for fixed reception (ATSC 3.0 standard) and mobile reception (5G-FeMBMS standard) using time division multiplexing within a terrestrial UHD broadcasting channel.

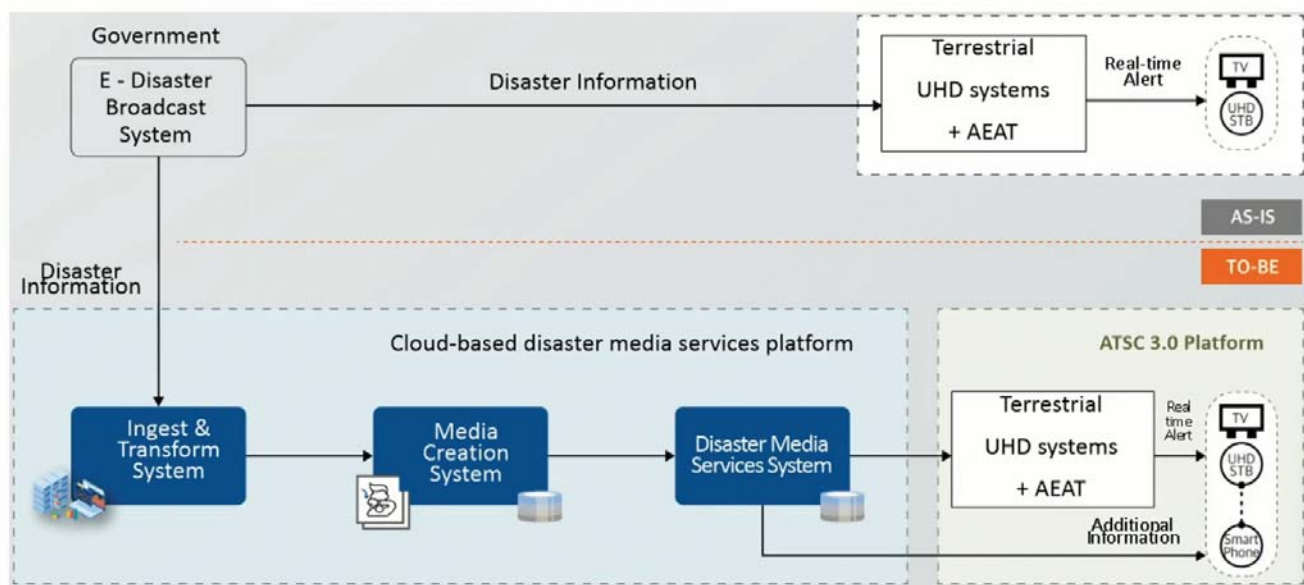
Webinar participants were introduced to the KOBA show and its showcases, which included demonstrations of video clips and layouts.

5-8. Disaster alert service using UHD networks

Next Stage?
Break the Frame!

KOBA

2023



Technologies for enhanced accessibility of live sports broadcasts – 27 July 2023, Thursday

The webinar session delivered on 27 July was entitled 'Technologies for enhanced accessibility of live sports broadcasts'. It was presented by **Masaki Takahashi**, Chief Lead from NHK Science and Technology Research Laboratories. The speaker discussed two media accessibility technologies for visually impaired persons introduced by NHK: one for audio descriptions and the other for haptic information. These technologies enhance the accessibility and immersiveness in live sports broadcasts, thus enabling the visually impaired to share the sensation of movement.

NHK broadcasts on two terrestrial TV channels, four satellite TV channels, and three radio channels. Also broadcasts international radio and TV on NHK World and NHK World Premium. NHK science & technology research laboratory is currently researching technologies for media accessibility to help disabled people and non-Japanese people. It is developing sign-language Computer Graphics for hearing-impaired people and English closed captions for non-Japanese people. Such research into

media accessibility is very important to contribute to the SDG concept, "Leave no one behind." Introducing the technologies for visually impaired people, NHK aims to provide a service that enables visually impaired people to enjoy live sports with family and friends. Visually impaired people cannot sufficiently understand the situations in live sports broadcast because announcers and commentators rarely describe visual information, such as superimposed texts and players' motions. There are two ways of information assurance, one being "Audio Descriptions" and the other, "Haptic Stimuli".

Audio Descriptions

Audio Descriptions are audio information provided to help visually impaired individuals understand TV content when they listen to it. For instance, while sighted people can observe a man and a woman wearing traditional Japanese clothes and crouching in a video, visually impaired individuals can only hear the conversation without understanding the context, such as their location or

Technologies for enhanced accessibility of live sports broadcasts

Masaki Takahashi received his B.S. and M.S. in Engineering from Keio University, Japan, in 1997 and 1999, and his Ph.D. from the Graduate University of Advanced Studies, Japan, in 2012. He joined the Japan Broadcasting Corporation (NHK) in 1999, and he has been working at the Science and Technology Research Laboratories from 2002. His research interests include sports video analysis and media accessibility technology. He was a visiting researcher at the University of British Columbia in 2012.



Masaki Takahashi
Chief Lead, STRL,
NHK-Japan

actions. By enabling audio descriptions, narration is added to describe the scene, allowing visually impaired individuals to better comprehend situations.

In Tokyo, the rate of providing audio descriptions is approximately 20%, which is lower than the almost 100% rate of closed captioning. This discrepancy is due to the challenges associated with creating audio descriptions, including high cost, time requirements, specialised skills, and significant effort. Consequently, audio descriptions are primarily available for recorded programmes, like drama and variety shows. However, visually impaired individuals have expressed a strong desire to enjoy live sports broadcasts with their families and friends. To address this demand, NHK has initiated research and development efforts to create and deliver audio descriptions for live

sports broadcasts specifically tailored to the visually impaired.

The system for creating and delivering audio descriptions for live sports broadcasts consists of four main components: descriptive text creation, a text-to-audio server, a delivery server, and a user's app. At the broadcast station, descriptive texts are generated using AI and an easy-to-use manual tool. Subsequently, the text-to-audio server converts the descriptive texts into audio descriptions. Finally, the delivery server broadcasts the audio descriptions to visually impaired individuals.

Haptic information

Video content has traditionally relied on visual and audio information to convey its message. However, incorporating

Technologies for visually impaired

NHK


Visually impaired people enjoy live sports!!



Haptic stimuli

- **Public Broadcaster (97% funding from reception fees)**
- **Domestic broadcasting corporation**
 - 2 terrestrial TV channels, 4 satellite TV channels (2K/4K/8K), 3 radio channels
- **International**
 - NHK WORLD, NHK WORLD PREMIUM, NHK WORLD RADIO
- **Network**
 - 54 domestic stations , 29 overseas offices



Headquarters: Tokyo, Japan



additional sensory elements, such as haptics or smell, can enhance the immersive experience for viewers. By leveraging new sensory media that convey various types of perceptual information, viewers can enjoy novel and engaging experiences while watching videos. Moreover, these additional sensory cues can also aid visually impaired individuals in understanding TV content. To this end, NHK has developed a haptic presentation system that can be utilised at public sports viewing events, among other applications. This system employs handheld and chair haptic devices to deliver haptic stimuli to viewers. Equipped with vibrators, these devices synchronise their vibrations with the video content being displayed. As a result, viewers can experience haptic feedback that is precisely timed with the video in real time.

The system's architecture involves several components. First, the broadcast video is distributed and analysed on a PC to determine the type and timing of haptic stimuli based on the athletes' motions. The haptic devices, which

viewers hold or sit in, are then wirelessly controlled to actuate in accordance with the video analysis results. Due to the processing time required by the video analysis module, the original video is delayed by approximately one second. Consequently, the haptic stimuli and audio/visual information on the video display are perfectly synchronised.

By providing haptic stimuli that correspond to specific actions performed by the athletes, the system enhances a viewer's sense of immersion and facilitates a better understanding of the game situation. This feature is particularly beneficial for visually impaired individuals, as it helps them perceive the ongoing match and comprehend the impact of specific actions.

Participants were able to view a real time demonstration with video clips and other features of the NHK research. Over 70 participants attended the webinar. They spanned 24 countries from Asia-Pacific and elsewhere, representing about 50 organisations. ■

Conclusion of Part I

- **Audio descriptions of live sports for the visually impaired using AI**
 - Visually impaired people can listen to audio descriptions using their smartphone at home
 - Our system consists of four parts:
 - Descriptive text creation
 - Text-to-audio server
 - Delivery server
 - User' s app
- **Descriptive texts creation is the heart of our system**
 - Character Recognition
 - Action Recognition
 - Manual operation

DAB+ DIGITAL RADIO - TECHNICAL WORKSHOP

NEW DEVELOPMENTS IN DAB+ SYSTEMS

WEBINAR SERIES, 18-20 JULY 2023

The Asia-Pacific Broadcasting Union (ABU), in collaboration with the Arab States Broadcasting Union (ASBU) and WorldDAB, jointly organised a Technical Workshop, from 18th to 20th July 2023, on DAB+ Digital Radio, focussing on the latest developments for DAB+ systems. The workshop aimed to provide broadcasters and other media professionals with an update on the most recent DAB+ advancements. Over three days, it was run as a webinar series and centred on various aspects, including the business case for DAB+, technical updates, system features, headend systems and transmission, and the intricacies of building out the DAB+ network.

The workshop was systematically structured as a three-part webinar series:

1. The first part concentrated on presenting the business case, a review of the latest standards updates, a robust discussion about the equilibrium between broadcast, IP, and 5G distribution, and updates on the German project integrating the DAB+ Emergency Warning feature into their national warning system.
2. The second segment delved into the initial steps for DAB+ integration, featuring presentations from esteemed industry leaders on the latest DAB+ system features and various implementation

options. A notable panel, comprised of international professionals, deliberated on the 'Initial steps' necessary to establish a DAB+ digital broadcast radio system effectively.

3. The concluding part addressed the technical side of DAB+ network design, discussed best practice implementations, and delved into the role of small-scale DAB+. It culminated in a panel discussion involving representatives from established network providers, where they elaborated on the necessary requirements and methods for DAB+ measurements and monitoring.

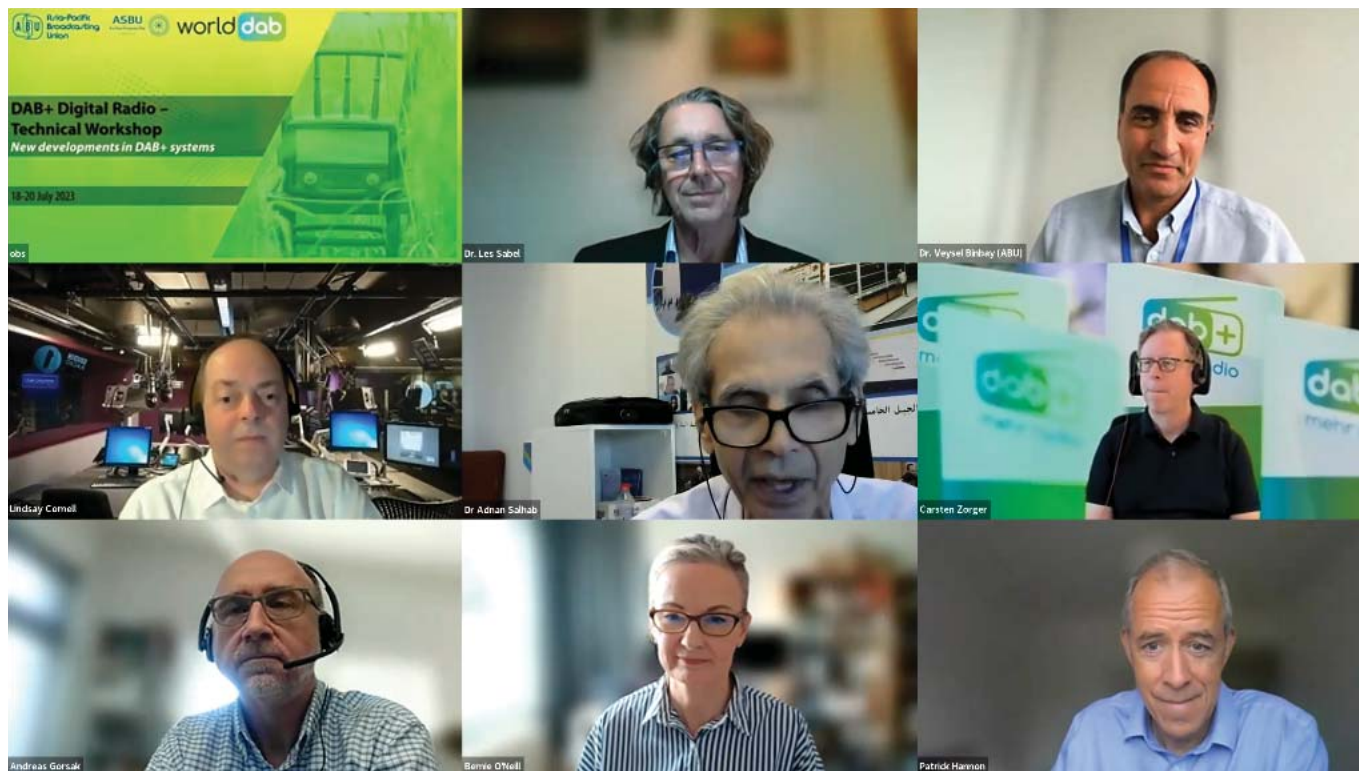
The main pillars of DAB+ revolve around its economic feasibility - providing distribution costs that are markedly lower than traditional FM. Environmentally, it boasts energy requirements that are more efficient than other platforms, and in terms of emergency situations, DAB+ stands out for its resilience, especially in out-of-home scenarios. As digital services continue to evolve and with shifting consumer preferences, it's imperative that radio strategies are recalibrated for this digital age.

The WorldDAB forum is actively working on refining the DAB+ standards specifically tailored for the ABU and ASBU regions. When it comes to DAB receivers,



DAB+ Digital Radio - Technical Workshop
New developments in DAB+ systems

18-20 July 2023



the ETSI standard TS 103 461 remains the foundational benchmark for most receiver testing. To ensure the versatility of the technology, additional core technology tests are being conducted. These tests are pivotal in ensuring that chipsets and modules in products can seamlessly deliver non-Latin text to appropriate displays. Furthermore, tests are underway to ensure receivers can respond promptly to emergency warnings transmitted over DAB.

When considering broadcast distribution, Broadcasters are committed to leveraging the delivery media that yields the maximum return for their respective businesses. They are incessantly working towards utilising optimal delivery methods to effectively reach their target demographics, exploring platforms such as DAB+, IP, and mobile 5G. However, it is pertinent to note that as of now, there is no compelling business case supporting the use of 5G Broadcast technology for radio delivery. The hybrid DAB+ system, with its capability to offer a rich media experience to both vehicular and domestic receivers, symbolises the future. Embracing this technology translates to improved and more targeted services for both consumers and radio businesses.

Drawing from their recent experience, Digitalradio Deutschland has successfully incorporated DAB+ for national emergency warnings. They advocate the consistent portrayal of DAB+ as a contemporary, user-friendly technology that ensures comfort, protection, and security - a sentiment that resonates not just in English-speaking nations but globally. Concurrently, it is imperative to delve deep into system features, receiver requirements, and other operational considerations to ensure maximum efficiency.

DAB is an advanced digital data delivery system, meticulously designed to provide a plethora of high-

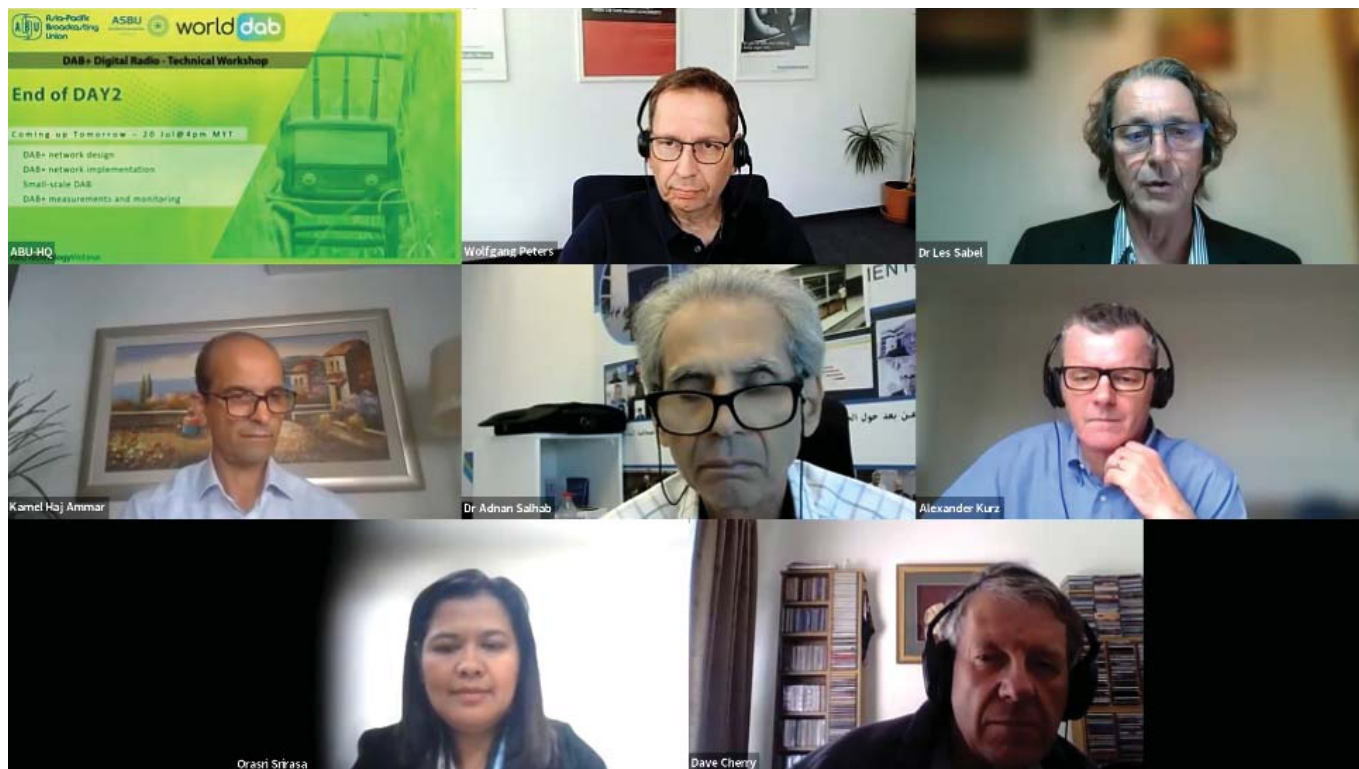
quality audio and data services on a singular transmission system. It is enriched with features such as emergency warnings and TPEG traffic services. To date, over 100 million receivers have been sold at price points starting from a mere \$15 USD. Most automotive brands have embraced the technology, with hybrid radio symbolising the next evolutionary step of DAB+ radio. This brings in IP service capabilities paired with cost-effective audio content delivery.

A DAB+ Headend is designed as a broadcast system that places a high emphasis on redundancy and availability. There are myriad options available for integrating audio programs into ensemble multiplexers, each presenting its unique set of advantages and challenges.

DAB/DAB+ employs Band III VHF to furnish an array of audio and multimedia services. The Maxiva transmitter product line up is varied, offering a spectrum of power levels. When selecting a transmitter, many factors come into play, ranging from its redundancy, output power, efficiency, to input connection options and even ease of maintenance.

During a panel session, industry experts highlighted the pressing concerns and challenges that plague the transition from trial phases to full-fledged regular services. Notably, trials in South Africa shed light on several hurdles encountered during the implementation phase. Key challenges included delays in acquiring the crucial Band III spectrum, restrictive trial periods set by regulations, prolonged waits for the granting of license extensions, and technical issues arising from TX combiners due to interference with analogue TV.

Prior to initiating the DAB+ Digital Radio trial in prominent cities such as Bangkok, a comprehensive trial meeting was convened. This brought together broadcasters, network



operators, and other pivotal stakeholders to deliberate on a myriad of issues. Discussions ranged from testing plans, service scenarios, communication strategies, technical and service tests for receivers, to user surveys and evaluations.

The Thai regulatory body took additional measures which included the formulation of policies, drafting of master plans & strategies, and developing support measures for capacity building, communications, and collaboration. They also focused on nationwide network planning and cost estimation for the extensive digital radio deployment.

In Tunisia, decisions related to the trial were executed in a phased manner. The nation's VHF band plan is geared to facilitate the transmission of 5 to 7 multiplexes, translating to roughly 140 radio programs for comprehensive national coverage. The projected headend is anticipated to incorporate 36 encoders in a 1+1 configuration, capable of transmitting 18 audio programmes. With the rollout of four new transmitters, Tunisia is ambitiously aiming to expand its national coverage to encompass up to 5 multiplexes by 2024.

An insightful presentation focussed on DAB+ network design, detailing coverage requirements and field strength reference levels. The presenter showcased how coverage areas and VHF propagation can be influenced by time and location, particularly in varied reception environments such as outdoor, indoor-suburban, indoor-urban, and indoor-dense urban settings. Field strength levels were correspondingly adjusted. The DAB VHF network can be tailored using either SFN or MFN Network configurations. Typically, an MFN Network is suited for hosting multiple multiplexes or diverse services, while an SFN is optimised for identical multiplex/services.

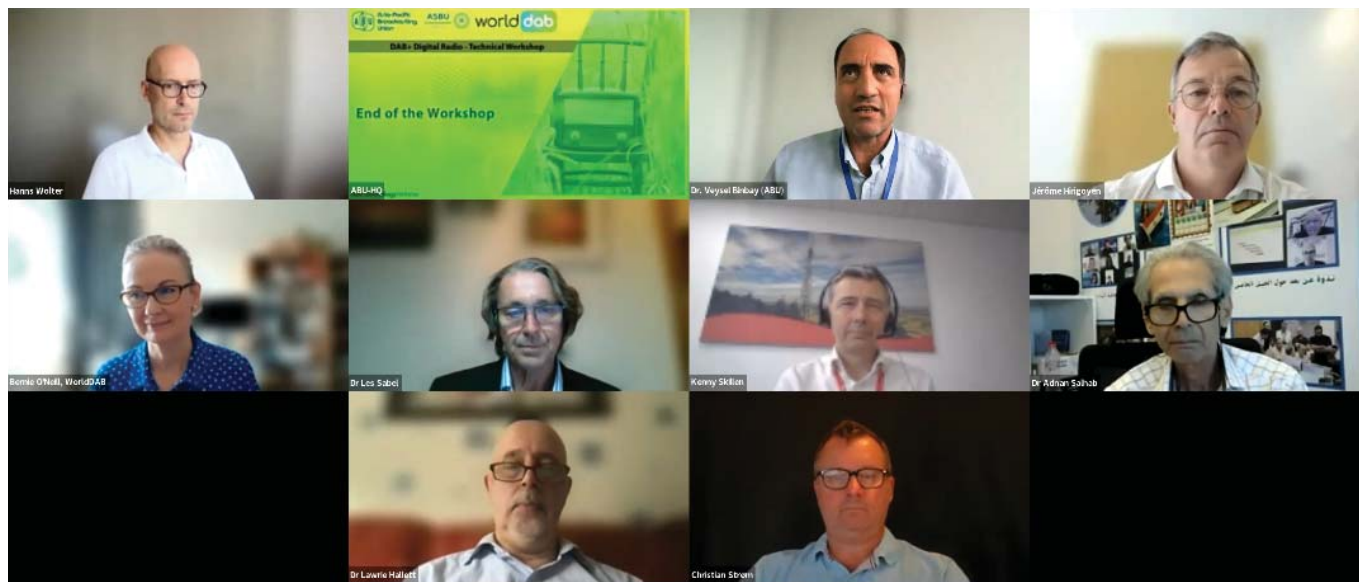
Several DAB+ network implementations are on the table. High Power High Tower (HPHT) configurations are

preferred for extensive coverage areas, swift network rollouts, or cost efficiency. In contrast, Low Power Low Tower (LPLT) setups are ideal for localised coverage, catering to local stations, enhancing indoor reception, or plugging gaps in the existing coverage, especially in areas where accessing HPHT sites proves challenging. Depending on the pre-existing network infrastructure and the unique morphology of the territory, a substantial number of transmitter sites might be categorized as MPMT (Medium Power Medium Tower) sites.

Occasionally, frequency planning at both national and international levels for DAB might introduce limitations, especially when using HPHT sites due to challenges in frequency reuse or intricate cross-border coordination. Drawing from an Italian case study, the recommendation was to minimize the use of HPHT sites and instead, lean more towards SFNs.

Further insights emerged from Future Digital Norfolk's digital radio deployment, which suggested that small-scale DAB implementations could encompass elements such as open-source technologies, internet-based signal distribution, and smaller service areas covered by low-power transmitters placed on rooftops or private masts. The UK's small-scale experiment illustrated the efficiency and reliability of open-source DAB resources and low-cost internet contribution feeds, thereby paving the way for the development of next-generation commercial equipment. Their network began operations with a singular transmitter catering to Norwich and its surrounding regions in the UK, starting in September 2022.

A subsequent panel session on DAB+ measurements and monitoring delved deep into various facets, spanning from the initial implementation phase to routine operations, system performance metrics, and



on-field testing for coverage verification. One standout case study from DAB Italia's network monitoring initiative highlighted the imperative nature of regular network monitoring, advocating for detailed analytical assessments. As networks burgeon in complexity, tracking delay issues becomes even more paramount. In intricate SFN scenarios, sometimes it proves more beneficial to deactivate a transmitter rather than letting it produce interference. Enhancements in service management or monitoring for DAB+ are on the horizon, marked by streamlined graphical presentation designs and the simultaneous display of timing data from identical SFN sites. By learning from past incidents, networks can boost their performance, and by setting precise thresholds, alerts can be triggered more efficiently.

Hosted by the ABU on the Zoom platform, the workshop witnessed the participation of 513 individuals, representing 55 countries from the Asia-Pacific region and beyond, and over 150 organisations. The esteemed line-up of speakers, hailing from diverse regions including Australia, South Africa, Tunisia, and Europe (encompassing the UK, France, Germany, and Italy), brought invaluable insights to the table.

Dr Les Sabel, who helmed and moderated the workshop, emphasised that the establishment of digital radio is inherently a protracted process.

Ms Bernie O'Neill, Project Director at WorldDAB, expressed her sentiments on the workshop, lauding its empowering nature which endowed delegates with critical information and skills in DAB transmission.

Dr Veyssel Binbay, Director of Technology & Innovation at the Asia-Pacific Broadcasting Union, articulated his hopes for the workshop. He envisioned it as a platform enabling participants to witness first-hand the shifts in radio broadcasting and the latest advancements. The focus was not just on technological breakthroughs, but also on sharing practical insights and real-life learning derived from the experiences of the professional speakers.

Dr Adnan Salhab, Head of the Technical Training Department at the Arab State Broadcasting Union (ASBU), gave an overview of the DAB+ trials and its evolution in the Arab region. He elaborated on initiatives in various countries, including Algeria, Tunisia, Saudi Arabia, Kuwait, UAE, Bahrain, Oman, Qatar, and Jordan. The ASBU technical committee has been diligent in its efforts, formulating and recommending receiver specifications for the region. These specifications are based on the ETSI DAB standard, with a particular emphasis on automotive applications. Dr Salhab expressed optimism about the future, emphasising his keenness to foster continued and productive cooperation with both the ABU and WorldDAB.

One of the core messages that resonated throughout the workshop was the transformative potential of DAB+. As media consumption patterns evolve and technology integrates deeper into daily life, the DAB+ system stands poised to redefine the radio experience for millions globally. Its advantages span economic, environmental, and emergency response domains, making it a formidable contender in the broadcasting arena.

The workshop's success was not just measured by the depth and breadth of topics discussed, but also by the diverse representation of participants. The digital platform facilitated the coming together of minds from across the globe, transcending geographical barriers. The diversity of voices, whether they were industry stalwarts, budding professionals, or curious enthusiasts, enriched the discourse, ensuring a holistic and comprehensive exploration of DAB+.

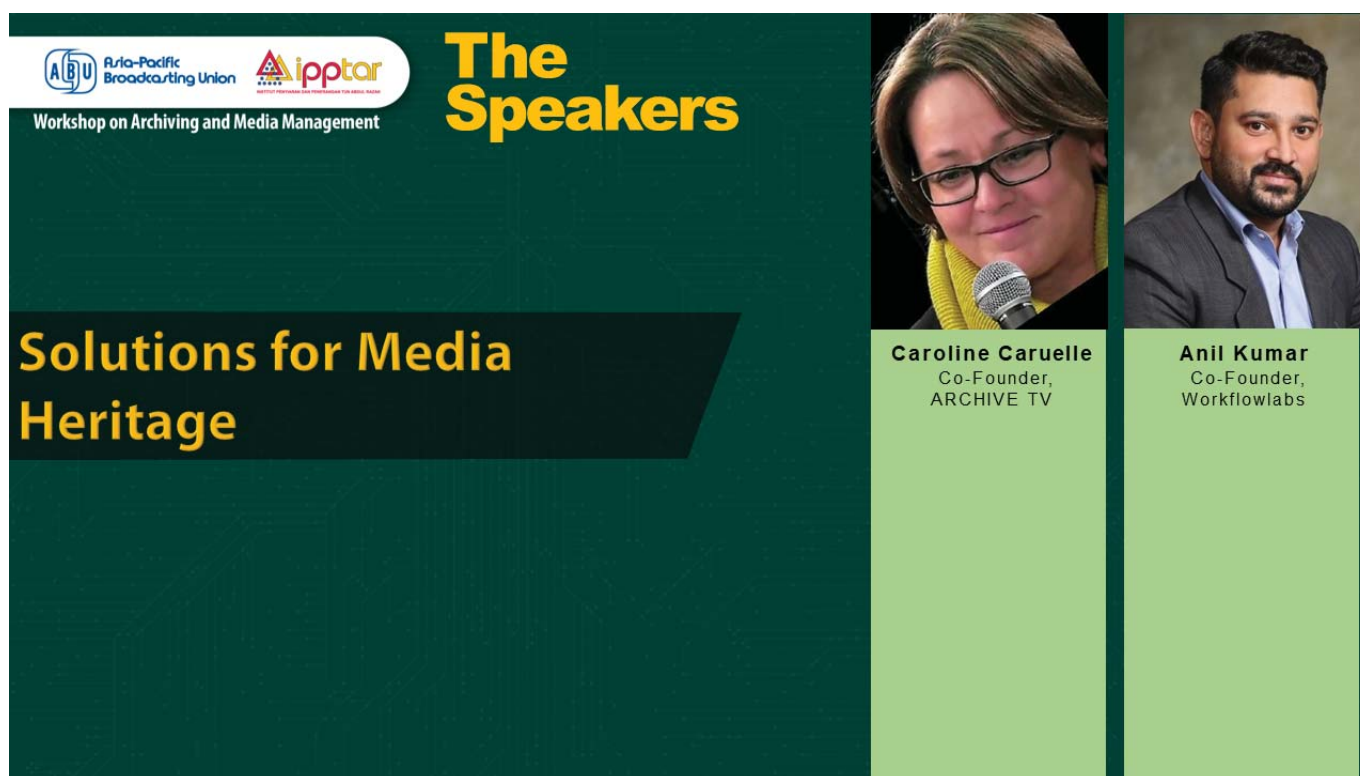
In conclusion, the Technical Workshop on DAB+ Digital Radio not only illuminated the path forward for digital broadcasting but also reinforced the importance of collaboration and knowledge sharing in this rapidly evolving domain. The collective expertise and insights shared over the three days have undoubtedly set the stage for the next chapter in the world of digital radio broadcasting. ■

ABU-IPPTAR WORKSHOP ON ARCHIVING AND MEDIA MANAGEMENT

1-3 AUGUST 2023, KUALA LUMPUR

Asia-Pacific Broadcasting Union (ABU) and Institut Penyiaran dan Penerangan Tun Abdul Razak (IPPTAR) jointly organised a workshop on Archiving and Media Management from 1-3 August, 2023. During the in-person workshop, some of the leading experts, from Cité de Mémoire, DAMsmart Asia Sdn Bhd, Disk Archive Corporation, RTM, IPSB Technology, AWS and Whiteways Systems, shared their approaches and solutions for archiving and management of audiovisual assets; also, how their decisions are helping with the process as well as the broadcast workflow.

Workshop 1: Solutions for Media Heritage by Cité de Mémoire, France



The Speakers

Solutions for Media Heritage

Caroline Caruelle
Co-Founder,
ARCHIVE TV

Anil Kumar
Co-Founder,
Workflowlabs

The first workshop session, on solutions for media heritage, was well delivered by **Caroline Caruelle** from Cité de Mémoire, France. Also representing Cité de Mémoire's partner in Malaysia, **Anil Kumar** from Workflowlabs outlined the Fusion platform offering diverse applications for digital asset management. The session deep-dived into prominent areas of digital media asset management, such as physical & digital heritage, heritage migration, heritage documentation, media asset management challenges, guidance and use cases.

Archiving & media management is a process that involves the collection, preservation, digitisation, and restoration of archive materials. It is an essential activity in the media and entertainment industry. The process includes auditing heritage collections extensively, building preservation and heritage migration strategy, and executing the migration projects until their successful completion. Cité de Mémoire specialises in heritage projects, off-site, or at customer's premise. Their process also involves audit, assessment of heritage collections, cataloguing and inventory, media asset management and indexing, digitisation for films, audio,



video or photo, exhibitions and audience-driven projects.

Archiving involves comprehensive inventory, the digitisation process, and physical preservation. A comprehensive inventory is done prior to digitisation and physical long-term preservation. The process includes visual inspection, playback, splices & repairs, dedusting and inputting metadata to databases. Digitisation is done in a prescribed format. Quality control is performed on high-res files. Transcoding is performed to create a low-res file that is ready to be used for dissemination to the audience or pre-editing. File storage is done using permanent equipment for production storage and near line storage.

Physical preservation involves returning assets to protective PVC containers which can be held directly on shelves for long-term storage. Indexing & asset management involves creating an indexing service that is fully searchable based

on many facets and browsable by authorised personnel using with high-performance search. Selected modules are leveraged for comprehensive inventory & quality selected content.

Fusion is a content management solution that provides a platform for media owners to effectively manage their content. It brings industry-leading innovations in data asset management and analytics. Fusion is storage agnostic, supporting Cloud, LTO, ALTO, ODA & NAS storage, and is built to scale with deep analytics capability. It works through a chain of managing assets, managing storage, quick search & find, organising & cataloguing, and easy access & sharing. Integrated with virtually every storage media in the industry, Fusion helps operators to create hybrid workflows with a mix and match of various storage solutions.





In addition, Fusion offers end-to-end media life cycle management for a wide variety of media (AV/Text/Docs) and document support. It enables easy & seamless access of the content & system in multi-locations. Additional modules may be integrated to further enhance its capabilities. Deep data analytics can help optimise content usage, sharing, infrastructure and manpower requirements. Fusion ALTO Plugin is an API-based deep integration with ALTO Disk archive including support for vault management and tape externalisation support. For example, Cite De Memoire works on restoration, correction digitisation and transcoding towards preparing content. Fusion manages content by managing, indexing, organising, cataloguing, archiving, retrieving and sharing. And Disk Archive Corporation prepares content by storing, archiving and retrieving it.



Anil Kumar, Co-Founder, Workflowlabs



Workshop 2: A to Z in Archiving and Media Management by DAMsmart Asia Sdn Bhd



Workshop on Archiving and Media Management

The Speakers

A to Z in Archiving and Media Management



T Vimalanathan
Vice President of
Sales (Asia)



Harnarain Gill
Administrative &
Logistics Manager
(Asia)

The participants in this session were walked through the following media industry requirements to establish a successful legacy content digitisation ecosystem within a client's environment:

- Curate and carry out interventive conservation on existing archives content.
- Harvest, enrich, and migrate the related technical and descriptive metadata to the chosen archiving platform.
- Address and overcome digitisation and restoration challenges.
- Re-purpose outputs to a myriad of delivery packages.

It is internationally acknowledged by archive bodies that the year 2025 is the deadline for all forms of analogue AV legacy content to be digitised. Failure to do so may result in the content being permanently undigitised. For a media asset management (MAM) system to not only automate

the archiving workflows, but also track manpower and processes, it must carry a comprehensive data model in associating analogue and digital assets with their related metadata. The path to carrying out all processes of digitisation, restoration, and content preparation with security and compliance involves several challenges. The solutions provided in the DAMsmart workflow include:

- Physical assets preparation & digitisation.
- Interventive physical restoration of tapes.
- Equipment to physically restore deteriorated films.
- Support for various tape formats and digital restoration.

Content preparation processes include several functionalities such as content assessment, transcoding to various digital deliverables, subtitling, audio dubbing, content packaging, and quality control to ensure the quality of the digitised content. Digital restoration encompasses the restoration of digitised content, addressing inherent tape/film artifacts. The content is digitised, restored, graded, upscaled, and AR converted.

Workshop delegates had an opportunity to visit DAMsmart's in-house facilities, equipment & hardware during the session; showcasing DAMsmart MAM solutions and seeing how, with the aid of tools & equipment, these help with curating, digitising the content in different reel formats and film archives. T Vimalanathan and Harnarain Gill conducted the in-person session at DAMsmart Asia's premises in Petaling Jaya.



Expert Christian Christiansen from Australia - walked the participants through a live demonstration of Media Room via a virtual presentation. Media Room is an on-cloud content management solution with content promotion, meant for media managers, distributors & producers. Media Room is one of the most accepted media management SaaS platforms in Australia and is generating significant interest in New Zealand and Southeast Asia. Taking advantage of cutting-edge technology, Media Room is now entering its third generation of development, with a completely re-engineered backend, utilising smart API structures to link into support technologies enhancing the frontend and user experience.



The focus has been completely honed to provide the best features for producers, content creators, media promoters and creative teams to quickly upload, manage and share content, bringing forward new marketing opportunities and rapid delivery of secured proxy or master files.

Retaining original high-profile security features such as password validations, HLS file encryption and watermarking, Media Room now incorporates two-factor authentication, default studio grade DRM, dynamic watermarking and direct initiator control of file transfer and viewing; making it one of the most secure asset management platforms available. Added to this enhanced upload and file transfer capabilities with Aspera on Cloud providing up to 3Gb/s speed, unlimited tagging capabilities and asset virtualisation across multiple projects makes file upload quick, easy and ultimately searchable. Storage capability takes advantage of an ever-expanding AWS S3 facility, itself providing higher reliability.



Workshop 3: Archive Strategies, Challenges, Innovations, and a Typical Archive Platform by Disk Archive Corporation

**Asia-Pacific
Broadcasting Union**

**ipptar**
INTERNATIONAL PROFESSIONAL PRODUCTION TRAINING ASSOCIATION

Workshop on Archiving and Media Management

The Speakers

Archive Strategies, Challenges, Innovations and a typical Archive platform



Alan Hoggarth,
Managing Director,
Disk Archive
Corporation



Bhavik Vyas,
Manager,
Disk Archive
Corporation

In this session, **Alan Hoggarth** and **Bhavik Vyas** at Disk Archive Corporation centred their talk around the following key areas aided with an offline ALTO unit, showcased alongside the training hall, and video footage:

- review of the currently available Film and Television Preservation technologies;
- share use cases of Archive Platform;
- discuss technology and operational characteristics of Archive Platform.

The challenges of Film & TV archive and preservation are numerous, including higher volume of production, higher resolutions, and locked-in, unplayable video or data tapes. Archive owners expect practical aspects, like lower lifetime cost, faster content access, lower power and AC consumption, total content security, minimising of initial capital investment, off premises archive hosting, uninterrupted media access and media location. LTO & ALTO are Tier 3 in the storage hierarchy. RAID, Cluster or Object storage are other options. The challenges with using options such as robotic tape libraries and optical disk archives with spinning disk storage are vulnerability, expense, increased security issues, plus outlay & lifetime cost.

Cloud is a financial model and a location, not a technology. A hybrid system combining ALTO for fast on-premises access with Cloud and tape tiers for disaster recovery gives a good combination of performance, cost and security. ALTO is a massive array of independent disks. Files are written sequentially on disk pairs, not

segmented. Disks are started & stopped individually to read & write. Only disks which are reading or writing are spinning. This results in massive power reduction, less than 240 watts per Petabyte, and a disk lifetime in decades. ALTO is a scalable cold storage solution for infrequently-accessed media storage optimised for television, film, audio & image preservation.

The ALTO technology is equally applicable for any structured or unstructured data adapted at the application layer for best-of-breed solutions. ALTO replaces outdated data tape libraries and replaces or complements optical or cloud offerings in open, standards-based systems with the



Alan Hoggarth, Managing Director, Disk Archive Corporation.



lowest lifetime cost of ownership, superior performance and outstanding environmental credentials.

Practically, digitisation refers to moving content from tape to file. Archival of media content, whether analogue or digital, is necessary for digitisation, post-production, and storage. The non-linear world of post-production goes through a chain of acquisition, manipulation, finishing, syndication, distribution and archival comes with file-based ingest and transcoding. There are multiple storage media in as many tiers tailored for post-production workflow or over-the-top (OTT) or video-on-demand (VOD) uses. Content monetisation comes in subscription video-on-demand (SVOD), transactional video-on-demand (TVOD), and advertising-based video-on-demand (AVOD) models.

Therefore, on-premises archives are important for monetisation and distribution via OTT or VOD essentially with long-term preservation, content versioning and updates, scalability, and efficient content management. OTT services with on-demand and live video streaming content are prevalent now on different platforms such as music streaming, live events, podcasts, video streaming, movies & TV shows, virtual film festivals, online radio stations, etc.

Speakers in the session also shared and outlined some use cases around the world including:

- Rwanda Broadcasting Agency with two Petabyte Platform to preserve a National Cultural Archive.
- Saudi Arabia Oil Company Media Archive.



- Royal Film Archive of Thailand in which 5 PB Platform is designed to expand over time to house the Royal Heritage Collection in Thailand.
- TV2 Denmark's National Television content archive with a 30 Petabyte platform to preserve a TV channel archive.
- Radio & Television Malaysia Media City Project, which is a 20 Petabyte fully redundant, high availability platform to preserve legacy and newly produced content at 2K resolution for the project in Kuala Lumpur.
- National Film Archive having super-scale 50 PB storage.
- High Court Evidence Archive with long term retention and fully redundant 14 PB archive.



Bhavik Vyas, Manager, Disk Archive Corporation.



Workshop 4: Archiving in the Modern Age: Balancing On-Premises and Cloud Solutions by IPSB Technology, AWS, and RTM



Workshop on Archiving and Media Management

The Speakers



Mardhiah Nasir,
Executive Director,
IPSB Technology



**Shazli Mansor
Bin Mohd
Ghazali**,
Public Sector
Solutions Architect,
AWS



**Ahmad Shafiq
Mirza Mansor**,
Senior Broadcast
Engineer, RTM

Archiving in the Modern Age: Balancing On-Premises and Cloud Solutions

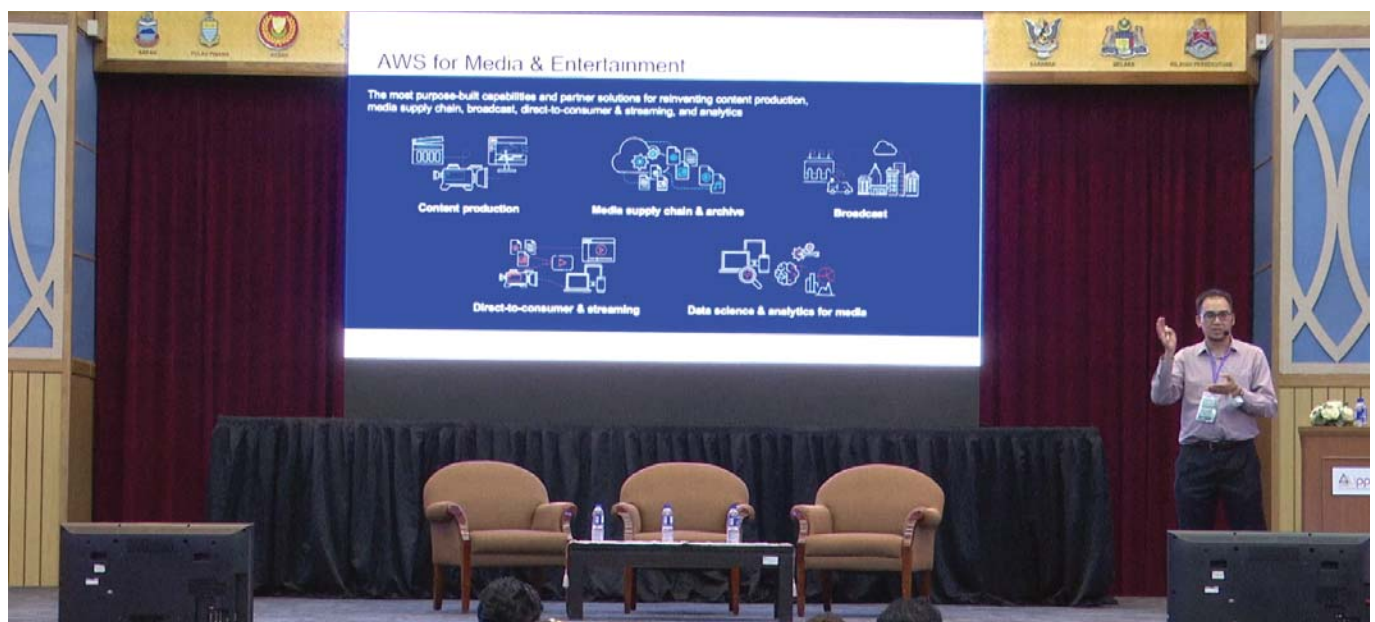
The panel of speakers deliberated on diverse issues of MAM solutions and implementations with individual presentations and panel discussion on:

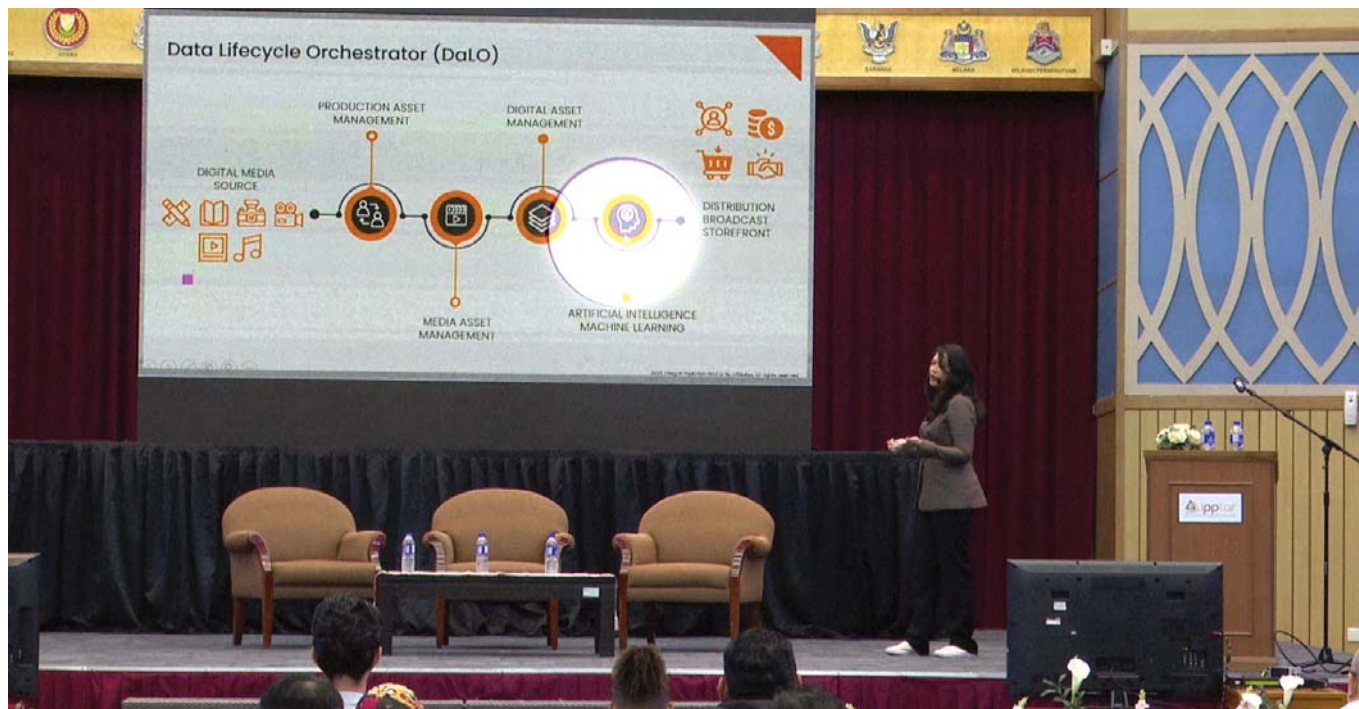
- workflow solutions for ingesting, processing, storing and monetising;
- success stories on storage and archiving;
- leveraging cloud architecture and bridging On prem & Cloud;
- RTM's use case in digitising and management of audio video archives.

Video storage management can be a daunting task for enterprise users. One of the main issues is the use of free storage applications like Google Drive and

Dropbox, which can lead to 'App Chaos'. This can result in versioning woes, with an overwhelming number of versions floating around. Additionally, the absence of standardised metadata and naming conventions makes storage organisation a difficult task. This leads to 'Unruly Metadata'. Another issue is 'Data Security Roulette', which is the nerve-wracking reality of file-sharing vulnerabilities that put your data at risk of unauthorised access. This can be a serious concern for businesses that deal with sensitive information. 'Storage Maze' is another issue that arises when navigating the labyrinth of manual storage maintenance and lacking efficient archiving policies. This can lead to duplication and silo workflow.

The problem of video storage management is like





working in a cave, where up to 40% of time is spent just finding material. This can lead to 'Patience is a Virtue', where waiting for data access can be frustrating when time is of the essence. It can also lead to the 'Black Hole', where files disappear as we don't even know what we are keeping - never enough storage. Finally, there is 'Missing in Action', which is a heart-breaking tale of lost files and reflecting on the unfortunate fate of files that go missing without a trace.

AWS has purpose-built solutions for content production, media supply chain, broadcast, direct to consumer and streaming. Likewise, AWS elemental for video editing and distribution to be tailored for broadcasters and other media applications. Other capabilities in the fleet are tools for data science and media analytics. Simple storage Service (S3) offers different benefits and provides storage. A lot of tools use S3 and S3 Glacier is used for archiving purpose. ESAS Hybrid Cloud Storage offers three options for storage: On Premise, Data Centre, and

Public Cloud. ESAS has been a reliable partner in meeting storage needs, providing innovative solutions that align with operational requirements. The Modern Age Storage Strategy, Data Lifecycle Orchestrator (DaLO), and Media Prima Enterprise Storage Archiving System (ESAS) are expected to further enhance the storage experience. As a user, one is thrilled to be a part of ESAS's storage expansion journey and witness their remarkable growth of up to 237%. You have no worries about the possibility of capacity shortage throughout the project.

RTM, the national broadcaster of Malaysia, initiated standardisation of its media material archives for effective operation, with a particular focus on media preservation for future needs for archiving and retrieval of media. RTM has delivered an integrated, scale-out infrastructure solution that interconnects 14 state-run regional news studios. It provides a global, Media Asset Management (MAM) solution to simplify workflow. Artificial Intelligence and Machine Learning are used across the ingested and



archived media to automatically extract rich metadata. The benefits of this solution include seamless media movement workflow, optimised cost and operations due to centralised storage and MAM, access to the entire media pool globally from any platform, and real-time news collaboration allowing multiple users to speed up the production cycle. For better management of the Media Archive, long-term planning must be consistent with the Product Life-Cycle investment.

Joining the fireside chat, with the title of 'Archiving in the

Modern Age', the panel of speakers outlined different projects in their purview and brainstormed pressing issues such as standalone storage, on -premises & cloud storage etc. Panellists Mardhiah Nasir from IPSB Technology, Shazli Mansor Bin Mohd Ghazali at AWS and Ahmad Shafiq Mirza Mansor from RTM also interacted with the audience to answer their questions, which included AI tools for searching audio files, design of central archive system, house format standardisation, choices between available cloud platforms & their reliability and the cost of frequent file conversions in Cloud.

Workshop 5 - Insight in Media Management, Archiving, QC, and Transcoding, conducted by Whiteways Systems



Workshop on Archiving and Media Management

The Speakers

Insight in Media Management, Archiving, QC, and Transcoding



Sudhanshu Gupta,
Sr. Manager Design,
Whiteways Systems



Abhishek Kapil,
Manager, Whiteways
Systems



Representing Whiteways Systems Pvt Ltd, **Sudhanshu Gupta** and **Abhishek Kapil** shared and discussed invaluable steps and guidelines based on use cases and company expertise. They emphasised the seamless integration of audio and video content of broadcasters with an efficient archiving solution that meticulously manages data quality by adhering to quality check and system. Main points in the presentation comprised:

- exploring advanced strategies for organising and cataloguing media assets to streamline workflows and optimise accessibility.
- discovering cutting-edge archiving technologies designed to ensure secure, long-term preservation of valuable media content.
- learning essential QC methodologies to uphold media integrity, ensure content compliance, and deliver high-quality media to audiences.

- diving into the intricacies of transcoding, including understanding different codecs, formats, and bitrate optimisation.

Whiteways is a company that takes responsibility for archival and digitisation projects from the planning stage to the handover stage. They have implemented many such projects across the Asia Pacific region for public and private organisations. Before starting the digitisation and archival process, there are several decisions that need to be made. These include creating a summary of the media, cataloguing the content on the tapes, deciding on the final archival file format, and preparing a storage space for the new archival medium. Additionally, third-party equipment like transcoders and quality checkers should be considered, along with metadata format and workflow design of the archival system.



The workflow steps for digitisation and archival processes include tape preparation & physical restoration, ingestion, metadata insertion and media management, transcode, quality check, software restoration of final edited content, storage & access, and archiving. A proper analysis should be made on what kind of archival system is best for the project. Users can choose any medium for archival such as disks, LTOs, ODAs or cloud-based archival system. Media asset management (MAM) offers flexibility in exporting media assets by accommodating various export requirements for different purposes. Different workflows can be defined in the MAM based on the origin of the content.

A typical case study of digitisation to archival and disaster recovery was presented. The steps involved in this process were requirement analysis, infrastructure installation, equipment installation, and project design for digitising the tapes. The project was divided into four stages: digitisation of the tapes, tagging and archiving the content, creating a disaster recovery site, and metadata database design. Additionally, the project involved other operational workflows and processes such as electrical & AC, security system, site visit, purchase order, after sales support, training and O&M structure proposal. Whiteways has experience in implementing such projects and can provide guidance on these steps.

On the second day of the workshop, an observational tour to Radio Televisyen Malaysia (RTM), Angkasapuri was organised for the participants to observe & inspect RTM's Archive Facilities. In its transmission operations centre, they learned about media asset management systems, storage, and inherent processes within the system. Also, they had opportunity to hear from the experts and frontline operators about RTM's ADiB centre, its High Definition (HD) News Digital Archive, installed and

operational in Wisma Berita. With the observation tour, the delegates could correlate and visualise the real time applications and deployments with the knowledge they received from the workshop presentations.

Head of Academic Department at Institute Penyiaran dan Penerangan Tun Abdul Razak (IPPTAR) Mr. Kumaran a/l Subramaniam welcomed the delegates to the in-person workshop and encouraged all to make the most of it. Mr. Ahmed Nadeem, Secretary-General at the Asia-Pacific Broadcasting Union (ABU), highlighted the emergence of new tools and technologies in the field of media asset management and welcomed the leading experts representing the workshop sponsors and expressed that their experience and insights would indeed be valuable to the workshop's ABU member delegates. In their concluding remarks, Dr Veyssel Binbay, Director of ABU Technology & Innovation at ABU, and Mazlina Mohd Yusoff, Head of Engineering Cluster for Training in IPPTAR, expressed that the thematic event had definitely offered valuable knowledge, skills and key takeaways to the participants and opined that it would help attendees to take further steps in digitising and preserving content for the future within their organisations.

The event was hosted at IPPTAR's premises in Kuala Lumpur. The content of the event was streamlined to cater for all broadcasters including technicians, engineers, producers, archivists and managers working with Radio and TV and Archive Centres. It was attended by 48 participants representing 20 organisations from 8 countries - Kiribati, Vanuatu, Indonesia, Malaysia, Vietnam, Brunei, Nepal and India. Participants were from Radio or TV broadcasters, Archive Centres, Universities, Telcos, News Agencies etc. representing Government and Private companies. ■



STANDARDISATION TRENDS IN OBJECT-BASED AUDIO TECHNOLOGY

Object-based audio technology offers high-quality sound by using 3D audio and enabling customisation of programme audio depending on the viewer. In order to implement object-based audio, it is necessary to record each object, create and attach metadata to the audio signals, and perform rendering in the viewer's home. This paper describes object-based audio technology and the trend of its standardisation.

1. INTRODUCTION

The cinema industry has been using object-based audio for nearly a decade, and products that support it, such as packaged media and home theatres, are becoming widespread. Moreover, the broadcasting industry has incorporated object-based audio in standards such as ATSC 3.0 [see ATSC, *ATSC Standard A/300:2022, "ATSC 3.0 System"* (2022)], which is the Advanced Television Systems Committee (ATSC) standard used in the USA and South Korea, and Digital Video Broadcasting – Second Generation Terrestrial (DVB-T2) [see ETSI, *ETSI EN 300 468 v1.16.1, "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB Systems"* (2019)], which is a standard for digital terrestrial television

broadcasting used mainly in Europe. One feature of object-based audio is that the rendering processing (signal processing) is performed on the reproduction system by using audio metadata. This enables a service to be offered in which the programme audio can be customised to match the viewer's preferences and viewing environment and give a strong sense of presence based on 3D audio.

This article gives an overview of object-based audio and describes the trends in the related standards.

2. OVERVIEW OF OBJECT-BASED AUDIO

Channel-based audio, which is the audio system currently used in broadcasting, creates a set of audio signals

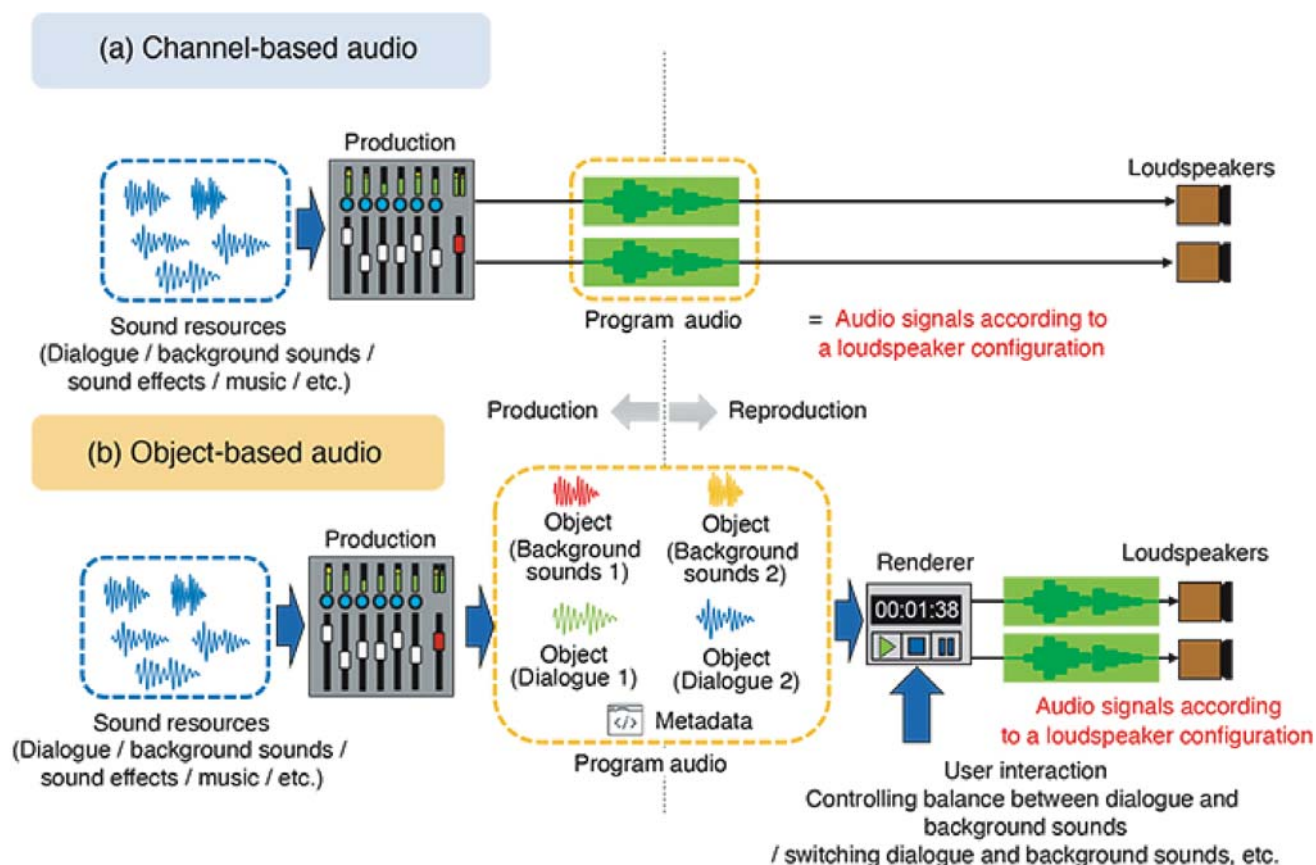


Figure 1: Channel-based audio and object-based audio

depending on the loudspeaker configuration used in the reproduction system (audio format) and transmits them to the home [See **Figure 1 (a)**]. In the case of stereo, the standard defines an arrangement of two loudspeakers separated by an angle of 60 degrees in front of the viewer, and the audio signals are recorded such that the first track is played from the left loudspeaker and the second track is played from the right loudspeaker.

However, in object-based audio, metadata is transmitted along with the set of audio signals. This audio metadata indicates which set of audio signals should be used as well as the intended positions in the 3D space they are reproduced in. The received signals are converted (rendered) into a different set of signals and reproduced by the receiver depending on the reproduction environment and audio metadata [See **Figure 1 (b)**]. In programme production using object-based audio, content

is created in a single 3D audio space instead of creating content for each audio format, such as stereo or 5.1 surround-sound, like in channel-based audio. However, since the number of audio signals to be transmitted grows large if the audio signals for all sounds are produced using object-based audio, programme audio is often produced using a combination of channel-based and object-based audio, such as by producing sets of audio signals for background sounds with channel-based audio and signals for more specific sounds with object-based audio.

Audio metadata is able to describe not only the intended reproduction position, but also which audio signals should be combined to compose the programme audio. For example, it is possible for the main programme audio to be a combination of an audio object of background sounds in 5.1 surround sound and an audio object

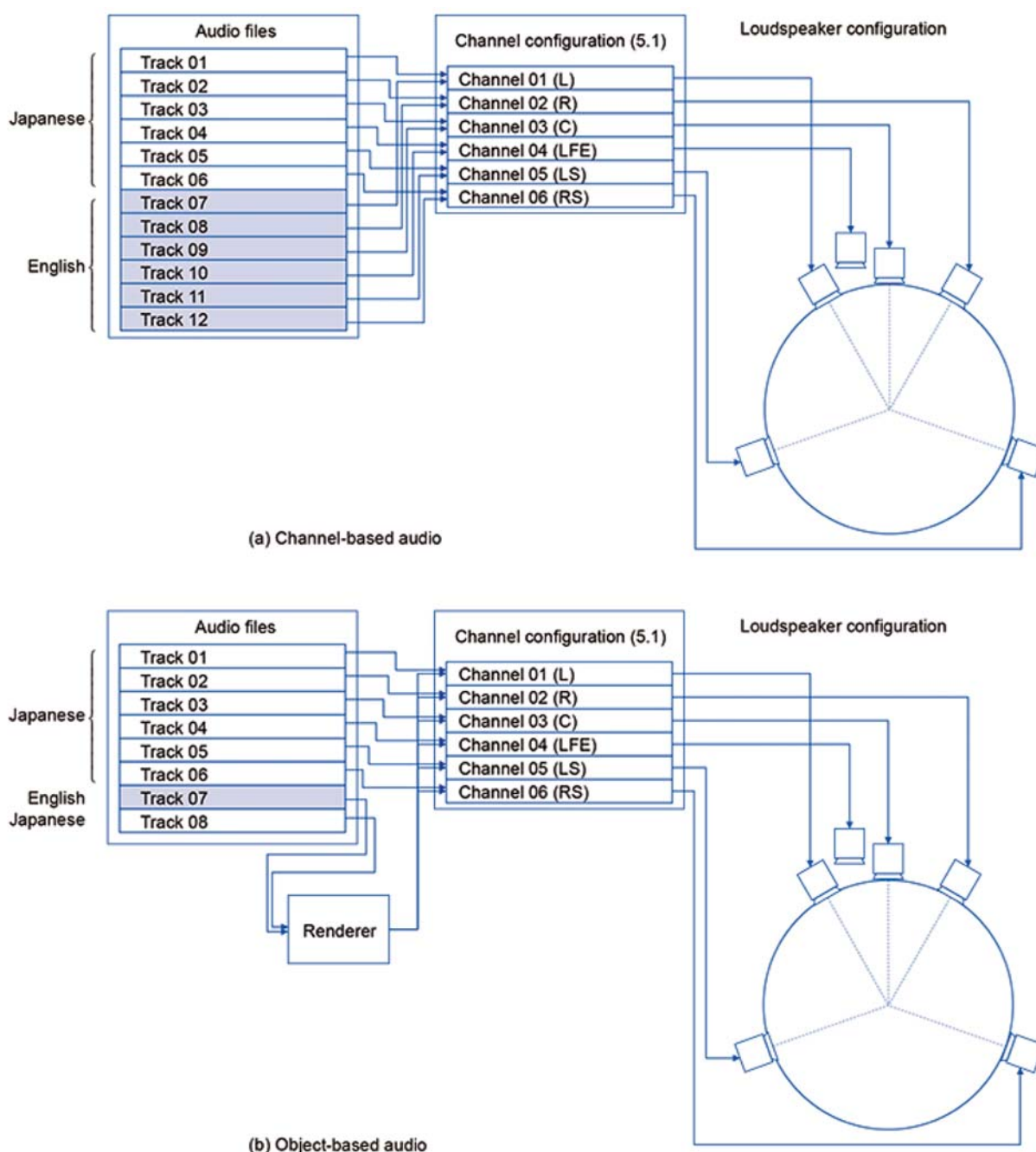


Figure 2: Relationship between audio tracks and audio channels (5.1 surround sound, 2 languages)

of Japanese-language dialogue in mono and for the secondary programme audio to have a mono audio object of English-language dialogue instead of the Japanese-language dialogue object. Moreover, multiple-programme audio services can be realised more efficiently with object-based audio. In the above example, while the number of channels of channel-based audio equals the audio format times the number of audio services, i.e., $6 \times 2 = 12$ audio tracks when providing 5.1 surround-sound programmes in two languages (6 channels: the audio channels are assigned to the L, R, C, LFE, LS, and RS loudspeakers), the number of audio tracks required in object-based audio is the number of channels in the audio format plus the number of audio services, i.e., $6 + 2 = 8$ [See **Figure 2**]. Furthermore, in the case of services offered in two languages, the orders of the audio tracks and audio channels may differ, as in, for example, playing the audio signal recorded on the seventh audio track through channel 1 ("Left (L)" channel which is assigned to a loudspeaker placed in front left) in 5.1 surround sound. The audio signals in the object-based audio are allocated to each of the audio channels in 5.1 surround sound by a renderer in the receiver.

Figure 2 shows an example where the audio format during production and the audio format during reproduction are the same, and the renderer in the receiver*4 optimises and reproduces the sound to suit the loudspeaker configuration in the reproduction environment regardless of the audio format used during production.

Object-based audio makes it easier to listen to live sports broadcasting that sounds so real, listeners may

feel as if they are in the supporter seats at the venue by muting only commentary. It also lets users manipulate programmes such as by removing the main vocals of a music video just like in karaoke. Moreover, playing the dialogue through a portable or wearable loudspeaker makes it easier to hear. All of these effects can be achieved by transmitting separate audio objects that make up a programme, such as separate dialogue, background sounds, and sound effects [See **Figure 3**].

3. STANDARDISATION TRENDS

3.1 ITU-R

The International Telecommunication Union, Radiocommunication Sector (ITU-R) began discussions related to standardisation of loudspeaker configurations for 3D audio starting in the early 2000s, and in

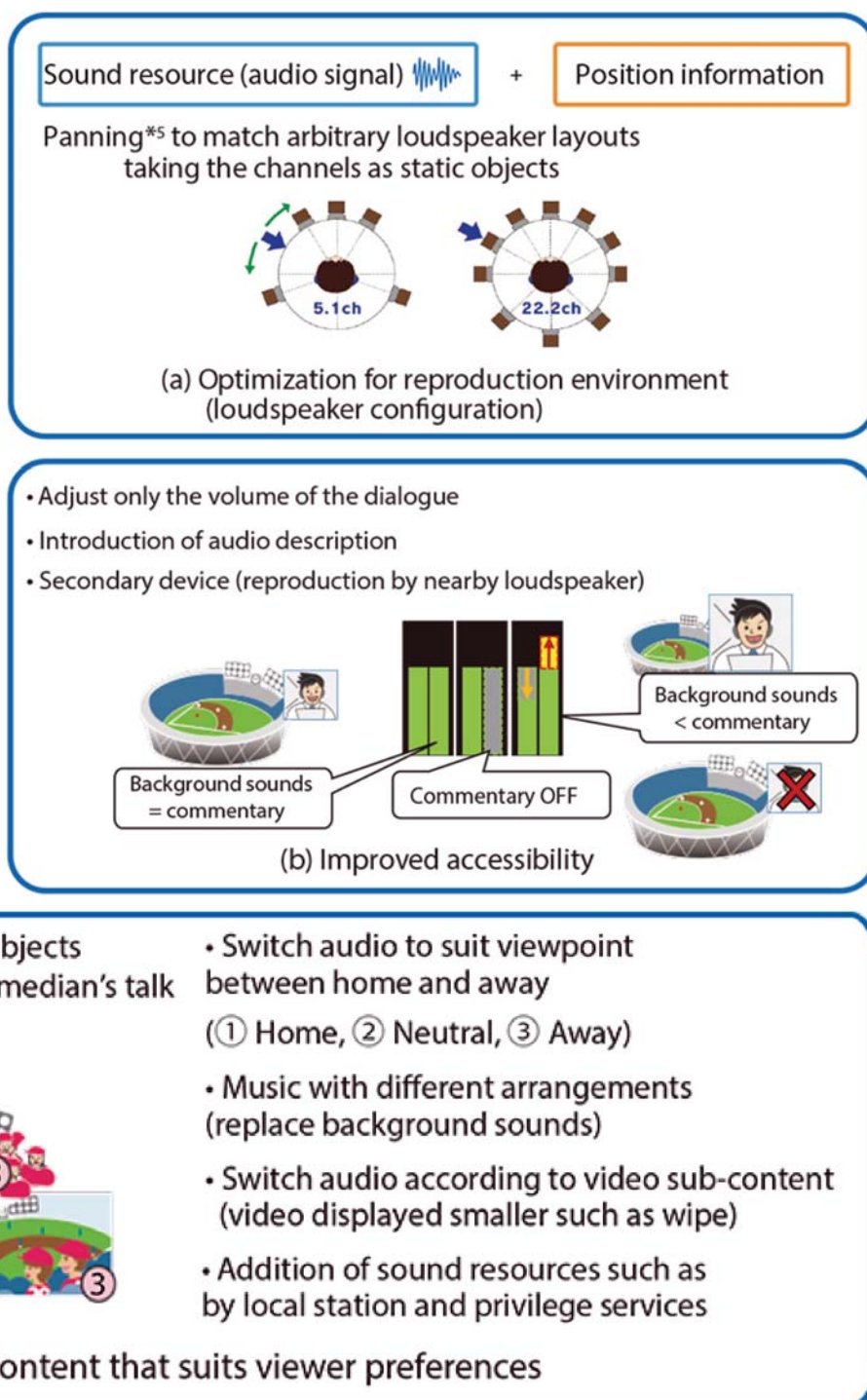


Figure 3: Broadcast services envisioned by object-based audio

2014 published a recommendation [See Rec. ITU-R BS.2051-3, “Advanced Sound System for Programme Production” (2022)] for channel-based audio, object-based audio, scene-based audio, and audio systems that are combinations of these. Recommendation ITU-R BS.2051 defines ten different loudspeaker configurations from stereo to 22.2 multichannel sound. In particular, since the audio objects of object-based audio can be placed at any position in the 3D reproduction space, the Recommendation specifies loudspeaker configurations for 3D audio. Here, STRL not only proposed 22.2 multichannel sound as an audio system for ultra-high-definition television; it also contributed to the Recommendation by proposing requirements for 3D audio and reporting experimental verifications on loudspeaker configurations.

(1) AUDIO METADATA

Audio metadata is required for programme production of object-based audio, and in 2015 the Audio Definition Model (ADM), which is audio metadata written in XML format, was published as Recommendation ITU-R BS.2076 [See Rec. ITU-R BS.2076-2, “Audio Definition Model” (2019)].

Figure 4 shows an overview of ADM for the case of a stereo programme for pulse code modulation (PCM) audio signals. ADM is a type of audio metadata that was originally standardised by the European Broadcasting Union (EBU). It consists of a content part containing audioProgramme, audioContent, and audioObject,

which describe the structure of the programme audio, and a format part that describes information such as the loudspeaker configuration of the audio objects (audioPackFormat) and the reproduction positions of the audio channels for “DirectSpeakers” and audio signals for “Objects” (audioChannelFormat). Whereas the various static parameters do not change during the programme in the case of channel-based audio signals, for object-based audio signals, dynamic parameters such as the reproduction position can change as time passes, and multiple audioBlockFormat sub-elements can be created over time.

In a bilingual programme, ADM allows the audio of the entire programme (audioProgramme), including the dialogue and background sounds, to be switched out [See Figure 5 (a)] or only some of the audio objects (audioObject), such as the dialogue, to be switched out [See Figure 5 (b)]. Although either method can be used when only the dialogue differs, the combinations of background sounds and dialogue can only be switched out as audioProgramme elements; for instance, in the sports programme example above, describing the immersive feeling of being in a stadium, the combination of background sounds from the team supporter seats and commentary focusing on the team the viewer is supporting could be switched out depending on which team the viewer supports.

ADM was amended in 2017 and 2019 by adding descriptors that describe the gain sub-elements used

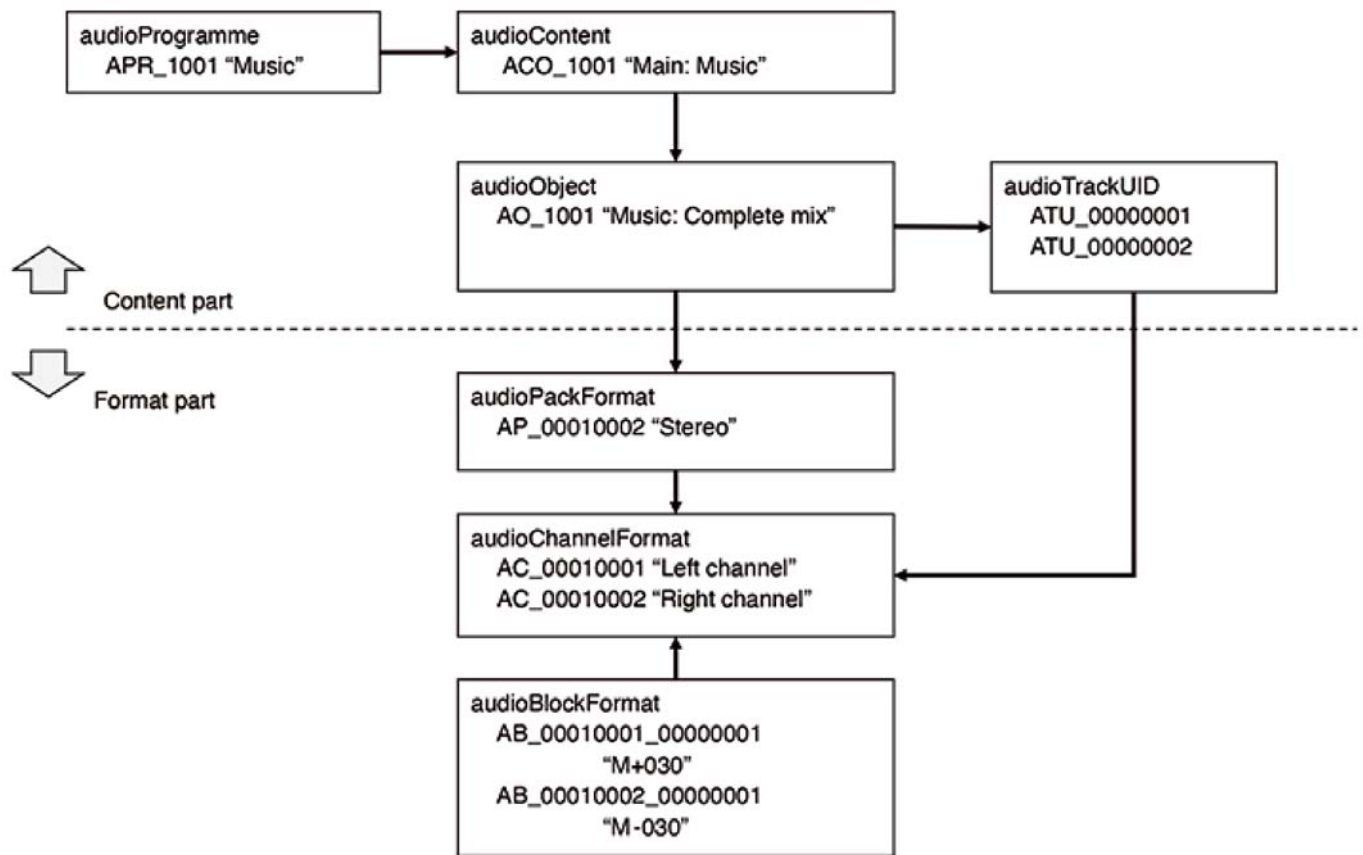


Figure 4: Overview of ADM metadata (for PCM audio signal)

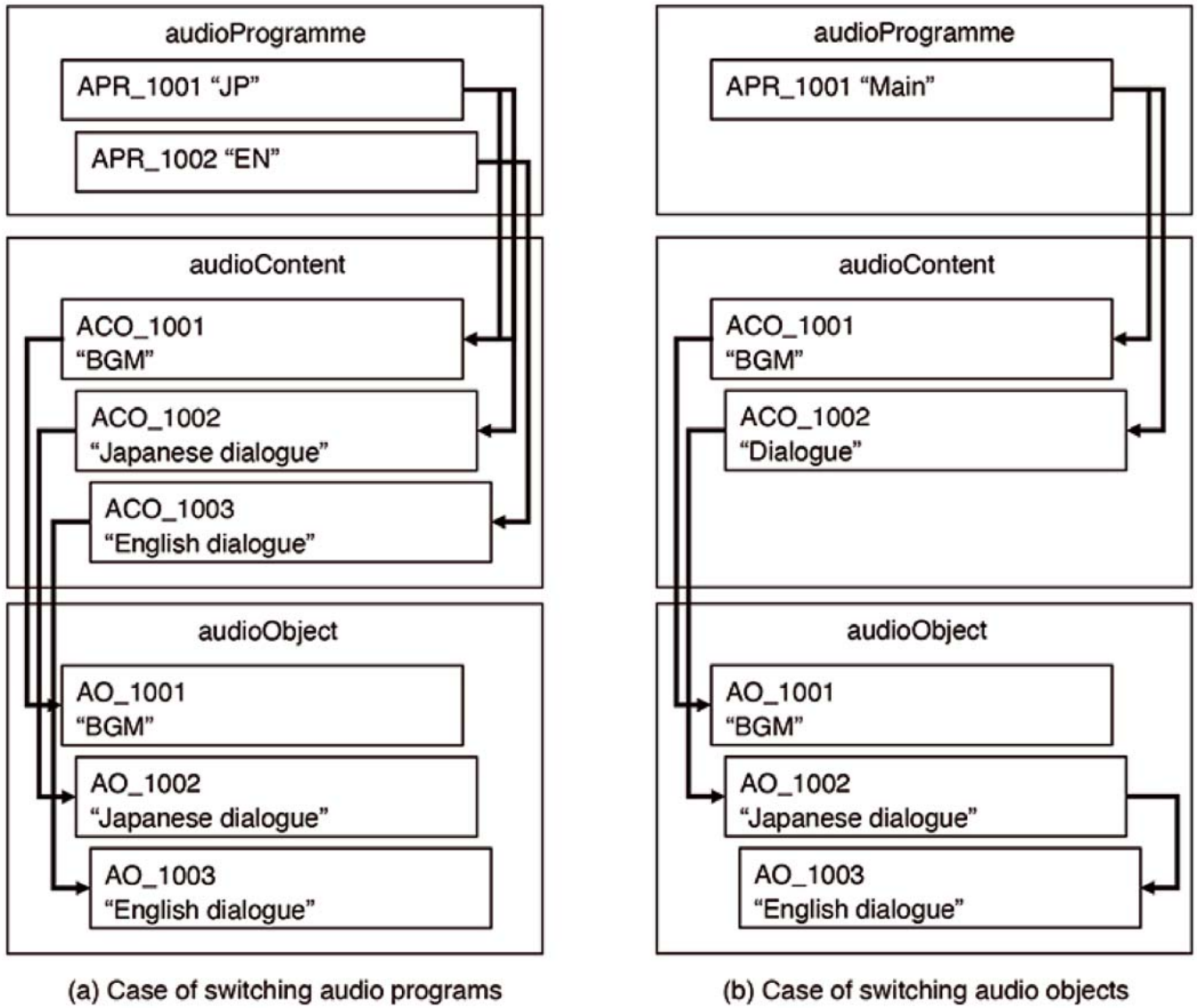


Figure 5: Examples of ADM metadata for bilingual programme

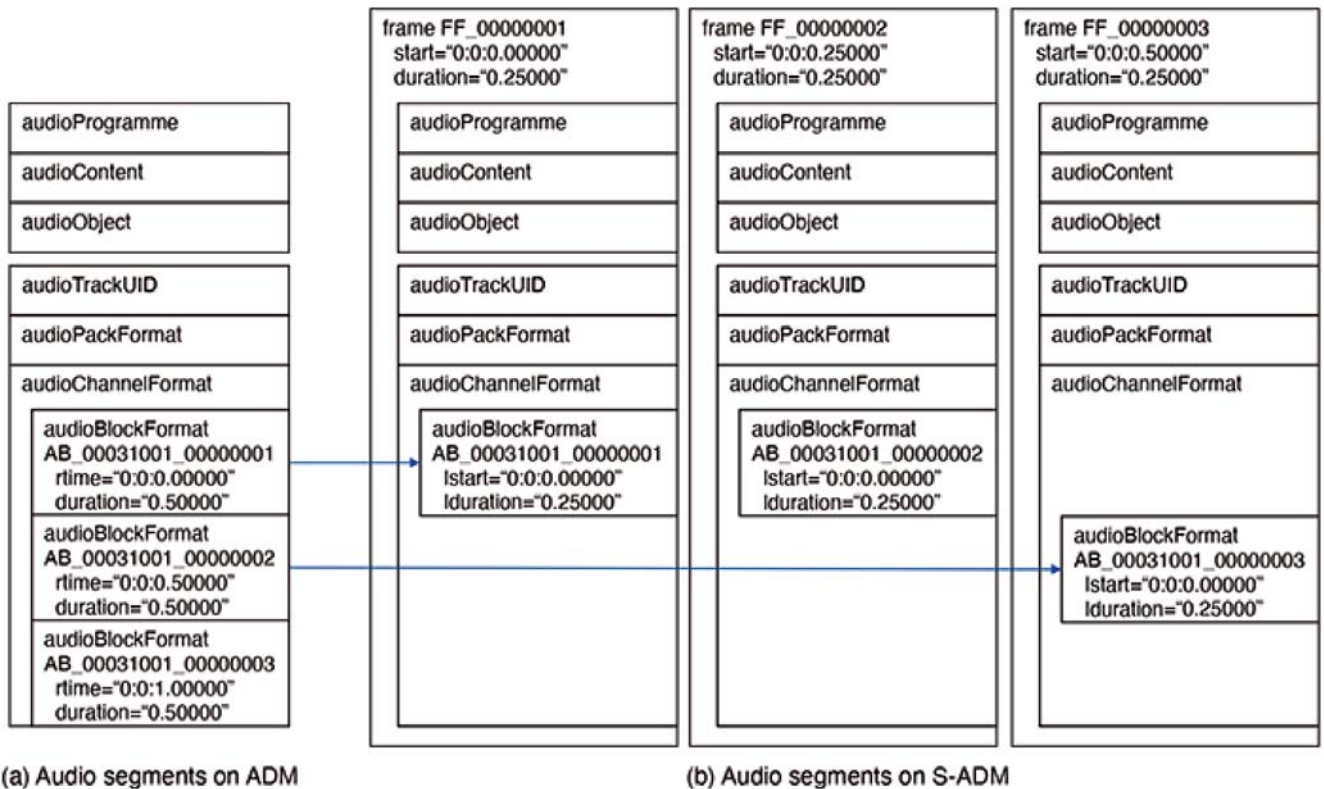


Figure 6: Relationship between ADM and S-ADM

to adjust the reproduction signal level for each audio object and alternative value sets for audio objects. Further amendments, such as extensions for immersive media, are expected in the future. Additionally, common definitions are specified for registering in advance a set of values for ADM elements that are frequently used, such as for the stereo loudspeaker configuration, with the aim of reducing the amount of ADM metadata attached in programmes [See Rec. ITU-R BS.2094-1, “Common Definitions for the Audio Definition Model” (2017)]. Descriptions of loudspeaker configurations and audio channels specified as the common definitions can be omitted.

Although ADM is envisioned for file-based programme exchange, a serial representation of it (S-ADM) for live productions was published in 2019 [See Rec. ITU-R BS.2125-1, “A Serial Representation of the Audio Definition Model” (2022)]. S-ADM extracts only the information needed for reproducing audio segments (frames) divided into fixed time segments. **Figure 6** shows the relationship between ADM and S-ADM.

Whereas in ADM, blocks in the audio channels are created when parameter values in the audio objects are changed and the time is specified from the programme start time, in S-ADM, blocks are created in each frame and the time can be specified relative to the start time of the frame. In 2022, there were discussions of profiles with the aim of simplifying the implementation by limiting the specifications to broadcast applications. By participating in these discussions, STRL contributed to Recommendations ITU-R BS.2076 and ITU-R BS.2094 and to standardisation of S-ADM by proposing the original draft.

Besides the above recommendations, Recommendation ITU-R BS.2088 [See Rec. ITU-R BS.2088-1, “Long-form File Format for the International Exchange of Audio Programme Materials with Metadata” (2019)] for a file format for international exchange of audio programme materials with ADM was published in 2015 and Recommendation ITU-R BS.2143 [See Rec. ITU-R BS.2143-0, “Transport Method for Non-Pulse-Code Modulation Audio Signals and Data over Digital Audio Interfaces for Programme Production and Exchange” (2022)] for an interface for transmitting S-ADM was published in 2022.

STRL contributed to development of Recommendation ITU-R BS.2143 by proposing the original draft for the S-ADM transmission system and conducting experimental verifications of the draft recommendations. Its efforts led to various countries adopting the file formats, transmission system, and ADM/S-ADM conversion technology.

(2) AUDIO RENDERER

Reproduction of object-based audio requires a renderer that interprets the audio metadata and generates a set of audio signals that match the loudspeaker configuration

of the reproduction site. In 2019, audio renderers for ADM were specified in Recommendation ITU-R BS.2127 [See Rec. ITU-R BS.2127-0, “Audio Definition Model Renderer for Advanced Sound Systems” (2019)]. The Recommendation includes an egocentric renderer that accurately reproduces the absolute positions of the sound sources in the virtual space represented by the audio metadata and an allocentric renderer that maintains the relative position between the audio objects and the reproduction loudspeakers. The egocentric renderer uses polar coordinates, while the allocentric renderer uses Cartesian coordinates, and each is supported by the audio-coding-system specifications of MPEG-H 3D Audio and AC-4 [See ETSI, ETSI TS 103 190-2, “Digital Audio Compression (AC-4) Standard; Part 2: Immersive and Personalised Audio” (2018)].

3.2 SMPTE

The Society of Motion Picture and Television Engineers (SMPTE) in the USA has released specifications, such as on audio metadata [See SMPTE, ST 2098-1:2018, “Immersive Audio Metadata” (2018)] and bit streams [See SMPTE, ST 2098-2:2019, “Immersive Audio Bitstream Specification” (2019)], with the aim of supporting interoperability with Next-Generation Audio (NGA) that has been in use by the cinema industry since the 2010s.

For programme production, SMPTE has released a specification [See SMPTE, ST 2109:2019, “Format for Non-PCM Audio and Data in AES3 – Audio Metadata” (2019)] for superimposing audio metadata in key-length-value (KLV) format onto AES3 audio signals, which is a widely used digital audio interface for programme production and a specification [See SMPTE, ST 2116:2019, “Format for Non-PCM Audio and Data in AES3 – Carriage of Metadata of Serial ADM (Audio Definition Model)” (2019)] for superimposing S-ADM onto AES3 audio signals.

As of 2022, there have been discussions on standards for writing content formulated using object-based audio in file formats such as Material Exchange Format (MXF) and Interoperable Mastering Format (IMF), which are used for content exchange such as broadcasting and internet distribution, standards for transmitting audio metadata in synchronised with audio signals using IP interfaces, and standards for alignment methods of acoustical conditions for interoperability with cinema content.

STRL has contributed to the development of these audio metadata-related standards such as by proposing standards for superimposing S-ADM onto AES3 audio signals, and jointly proposing a standard formulation project to develop ADM plug-in for MXF and IMF with European Broadcasting Union etc.

A general-purpose data storage method made up of triples consisting of a data identifier (key), data length indicator (length), and data itself (value).

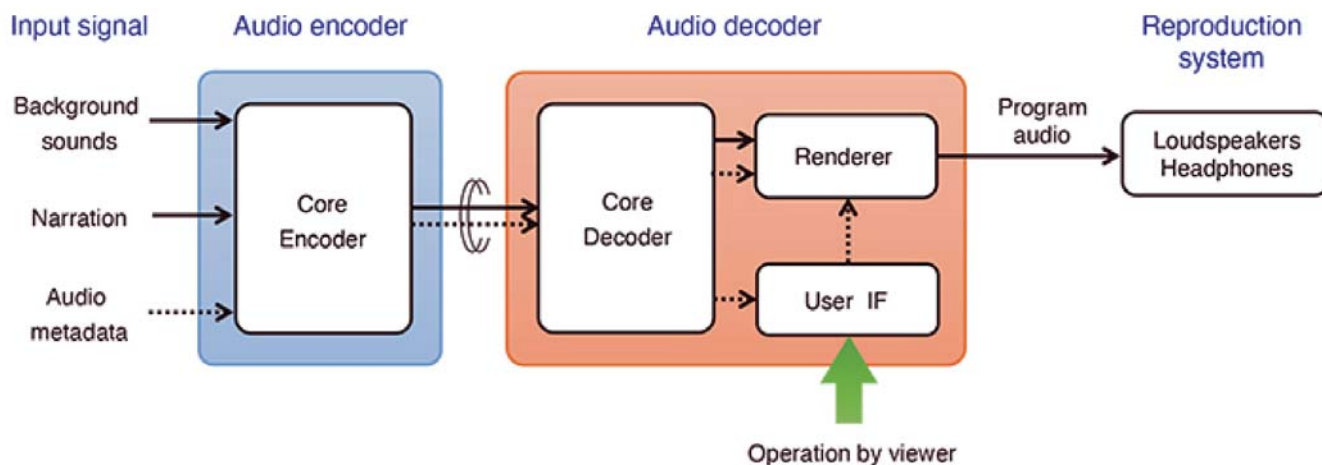


Figure 7: Structure of MPEG-H 3DA audio encoder/decoder

3.3 MPEG AUDIO CODING

The Moving Picture Experts Group (MPEG) began to standardise MPEG-H 3D Audio (3DA) [See ISO/IEC 23008-3:2019, "Information Technology – High Efficiency Coding and Media Delivery in Heterogeneous Environments - Part 3: 3D Audio, 2nd ed." (2019)] in Audio Coding (ISO/IEC JTC1/SC29/WG6) around 2013. The aim was to specify an audio encoding system that supports the 3D-extended loudspeaker configurations specified by ITU-R and the various channel-based, object-based, and scene-based sound systems [See Rec. ITU-R BS.2051-2, "Advanced Sound System for Programme Production" (2018)].

The main profile, which is the base of the standard, was published in 2015, and a low complexity (LC) profile for broadcasting implementations was published in 2017. The second edition, including amendments and corrigenda, was published in 2019, and a new baseline profile that reduces the implementation load by removing higher-order ambisonics (HOA) from the LC profile was published in 2020 [See ISO/IEC 23008-3:2019/Amd.2:2020, "3D Audio Baseline Profile, Corrections and Improvements" (2020)]. STRL contributed to the standardisation of the level at which 22.2 multichannel sound can be transmitted in the LC profile and standardisation of the baseline profile for advanced terrestrial broadcasting in Japan. Among the many audio-quality improvement tools used in MPEG-H 3DA, the main ones include technology for recovering frequency components that go missing due to compression (intelligent gap filling) and a bit allocation method using auditory masking between channels (multichannel coding tool).

These advanced technologies are not built into the current audio coding method for broadcasting, called Advanced Audio Coding (AAC), and are used in the next-generation broadcasting standard (ATSC 3.0) in the USA and South Korea. Research on these technologies is ongoing.

Figure 7 shows the structure of the MPEG-H 3DA audio encoder/decoder. The audio encoder uses the core encoder to compress the input audio objects, such as

background sounds, narration, and audio metadata, and combines them into an audio stream. The audio decoder uses the core decoder to decode the input audio stream. The viewer can customise the programme audio via the user interface (IF). The renderer composes and outputs the programme audio by using the decoded audio objects, audio metadata, and operations by the viewer. The output is played through loudspeakers or headphones.

3.4 ARIB

The Association of Radio Industries and Businesses (ARIB) sets the broadcasting standards in Japan. ARIB has standardised 3D multichannel audio (STD-B59) and has contributed to international standardisation of object-based audio in its own working group responsible for research and development of audio systems. In 2021, a task group was established to compare audio coding systems that support object-based audio at the request of the Information and Communication Technology Subcommittee of the Ministry of Internal Affairs and Communications, and an investigation was started into next-generation broadcasting services using object-based audio. The task group has since conducted subjective evaluation experiments for checking the bit rates that satisfy broadcast quality requirements and subjective evaluation experiments for checking the differences in audio quality of various rendering technologies.

These experiments have shown that the candidate audio coding systems (MPEG-H 3D Audio and AC-4) have no large quality differences between them, and both meet broadcast quality requirements. An investigation into the technical conditions of audio formats used in next-generation broadcasting services was started in 2022 and its findings will be incorporated in a report on advances in terrestrial broadcasting planned for 2023.

Starting from 2023, there are plans to make amendments to STD-B32. Furthermore, investigations are proceeding into standards for programme production studios using object-based audio, such as subjective evaluation experiments on loudness measurement methods that

support object-based audio and discussions on an audio metadata profile for programme production. STRL has contributed to working group activities such as publishing standards for 3D multichannel audio, conducting comparison experiments on audio coding systems, and conducting loudness measurement experiments.

4. SUMMARY

This paper gave an overview of object-based audio and described trends in standardisation. In the future, we will continue to promote domestic and international standardisation activities towards practical application of object-based audio.

AUTHORS



OODE Satoshi

Chief Lead of the Advanced Television Systems Research Division, NHK STRL

OODE Satoshi joined NHK in 1999. After working at the Broadcast Engineering Department, he moved to STRL in 2001 to conduct research and standardisation of acoustic cognitive science, 3D audio, and object-based audio. He currently serves as the Chief Lead of the Advanced Television Systems Research Division at STRL. He holds a Ph.D. in Information Science.



SUGIMOTO Takehiro

Expert in the Advanced Television Systems Research Division, NHK STRL

SUGIMOTO Takehiro joined NHK in 2001. After working at the Broadcast Engineering Department, he moved to STRL in 2004 to conduct research into the development and standardisation of audio encoding methods, 3D audio, and audio transducers. He currently serves as an Expert in the Advanced Television Systems Research Division at STRL. He holds a Ph.D. in Engineering. ■

How to contribute to the Technical Review

Would you like to contribute an article to the ABU Technical Review? Anybody is welcome to do so.

It's an excellent way to highlight the work your organisation is doing and bring it to wide attention.

We will be happy to consider publishing any article you contribute. This could be a paper on research your organisation is conducting, details of any new technical developments, or any other article you feel will be of general interest to TR readers.

As you may be aware, the Technical Review is a quarterly publication distributed to all ABU members and industry partners.

It is available to the technical staff in each member organisation and in international organisations such as the ITU and other broadcasting associations, as well as in universities.

The Technical Review is aimed at engineers but also carries general interest news stories. It contains articles on new technologies, developments in broadcasting, innovations by members and other material of interest to engineers.

An article can be any length and written in any style you like. If you have photos to accompany it, they should be high resolution (at least 2 megapixels).

Although we cannot offer payment, we will offer a free half-page advertisement for some articles, particularly those covering technical research. This will be placed after your article, bringing publicity for your organisation.

In addition, articles written by ABU members on Case Studies, Research and Practical Implementation will be considered for the annual ABU Technical Review Prizes which consist of a cash prize and certificate.



Previous issues of the Technical Review can be viewed at the ABU website main page and at: <https://www.abu.org.my/technical-review/>

If you need more information, please contact veysel@abu.org.my ■

Annual ABU Technical Committee Meeting 2023 to be hosted by Korean Broadcasting System (KBS) in Seoul, South Korea

The ABU Technical Committee's annual gathering is set to take place on the 28th and 29th of October. This year, it will be hosted by the Korean Broadcasting System (KBS) as an integral part of the ABU's 60th General Assembly and Associated Meetings.

The major agenda is the Technical Committee elections on the second day where eighteen (18 members) to the ABU Technical Bureau, new Chairman and vice chairmen of ABU Technical Committee will be elected for years 2024-2025. Among the noteworthy highlights of TC2023, participants can look forward to the announcement of the winners of the Annual Engineering Award and Technical Review Prizes during the opening session of the event.

The first day session of TC2023 will feature a keynote presentation delivered by an NHK expert, providing valuable insights into and highlights of NHK researches on Emerging Technologies for Future Public Media. In terms of administrative matters, the TC will delve into essential decision stemming from the Technical Bureau. This decision on 'Implementing Attendance Policy for Bureau Meetings' will ensure the Bureau's effectiveness and that every decision and recommendation is made with the collective wisdom and experience of the entire Bureau.

The invited presentations at TC2023 will revolve around two central themes: "Advancements in Broadcast Technology and Services" and "Latest Technology Implementations and Use Cases." These discussions promise to be both enlightening and forward-thinking.

Another highlight of the gathering is the customary "The Host Presents" session, a platform where the host, in this case, KBS, will showcase key technological projects and developments that have been shaping the industry.

Over the course of the two-day meeting, attendees will have the privilege of hearing from the Chairmen of the Study Topics, who will provide updates on ongoing projects within the domains of Production, Distribution, Spectrum, and Training & Services.

As is tradition, the TC2023 meeting will attract CTOs, technical heads, and senior engineers from ABU member broadcasters. It will also draw in industry experts from solution providers and industry partners not only from the region but also from around the globe. This annual TC meeting is a valuable platform for engineers, technology enthusiasts, and industry experts to come together, share experiences, exchange knowledge, and engage in discussions on issues of mutual concern among like-minded colleagues. ■

ABU 2023
SEOUL

Technical Committee Meeting

[Register Here](#)

28.10.2023 – 13:30-17:00 & 29.10.2023 – 9:00-17:00

ABU 2023 SEOUL

60TH ABU GA2023 HOST



Historic Beginnings: Korean Broadcasting System or KBS, etched its name in history by becoming the pioneer in radio broadcasting in Korea, introducing radio broadcasts to the nation's audience as early as 1927.

Post-Liberation Transformation: After the liberation of Korea, KBS underwent a significant transformation in 1947 when it was reborn as the Seoul Central Broadcasting System, marking a new era in its journey.

Television Emergence: In 1961, KBS ventured into the world of television broadcasting, captivating viewers with a visual medium that would soon become a cornerstone of its operations.

Public Broadcasting Identity: In 1973, KBS took a pivotal step by evolving into a public broadcasting system known as the Korea Broadcasting Corporation, solidifying its role in providing quality content and services to the public.

Diverse Broadcasting Portfolio: Today, KBS boasts an extensive array of broadcasting offerings, including four terrestrial TV channels - HD 1, HD 2, UHD 1, and UHD 2. Additionally, it operates two satellite TV channels, KBS World and KBS KOREA, while maintaining a presence with seven radio broadcasting channels.

Innovative Services: KBS doesn't stop at traditional

broadcasting. It has ventured into new media services with platforms like MY K, ensuring it stays at the forefront of the media landscape.

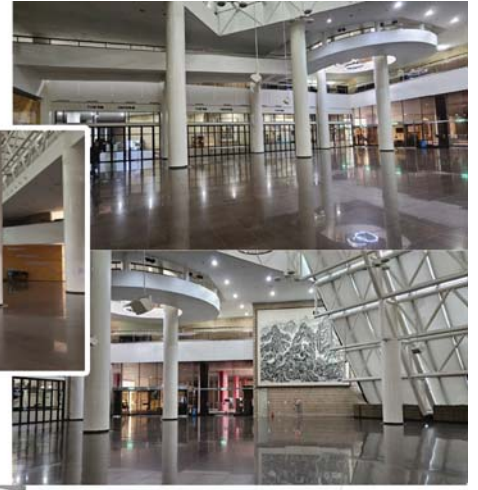
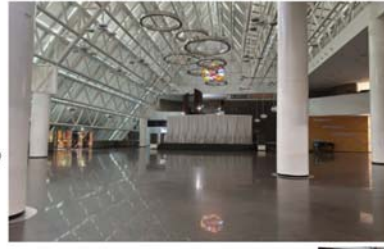
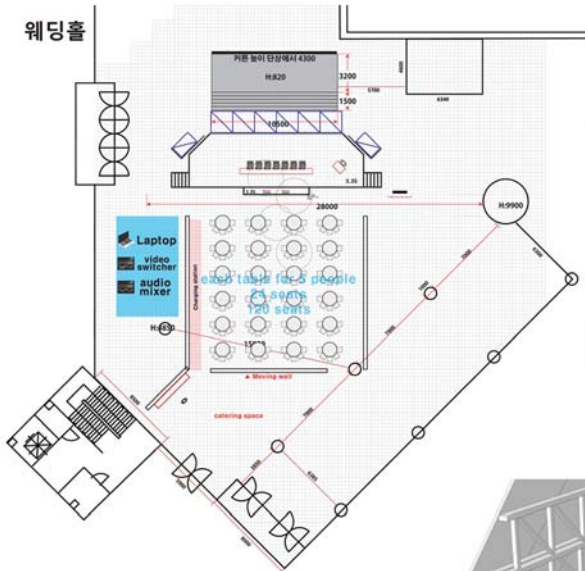
Global Reach: With its headquarters located in the bustling district of Yeouido in Seoul, KBS extends its influence across the country, operating the General Broadcasting Bureau in nine major cities and broadcasting stations in nine different regions. Furthermore, it maintains a global presence with bureaus in locations such as the United States, Europe, China, Japan, and more.

Cultural Promotion: Beyond broadcasting, KBS actively promotes culture and the arts. Its remarkable KBS Hall, which can accommodate more than 10,000 spectators, serves as a hub for cultural and artistic events.

Musical Ensembles: KBS further enriches the cultural landscape by nurturing musical talents. It operates the KBS Symphony Orchestra and the KBS Gugak Orchestra, contributing to the nation's musical heritage.

Accessibility and Innovation: KBS is dedicated to solving the challenge of ensuring access to its services in remote and mountainous regions. Moreover, the organization continually invests in research and innovation to pave the way for next-generation broadcasting services.

웨딩홀



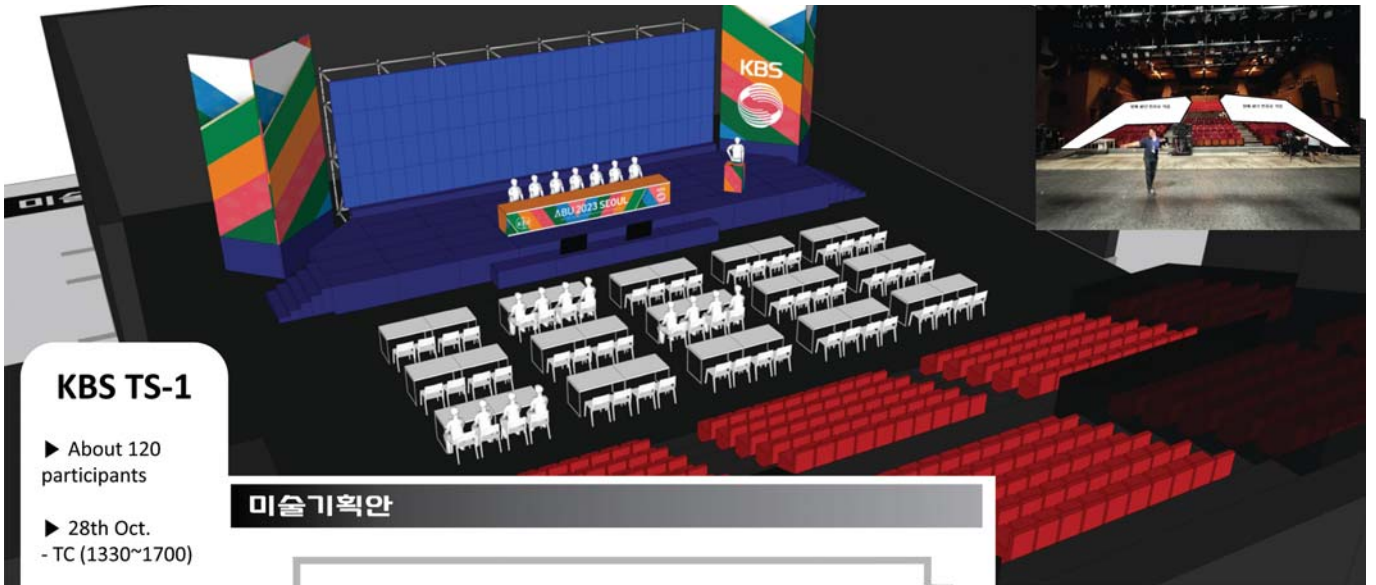
KBS Wedding Hall

▶ About 130 participants

▶ 28th Oct.
- SMCC (1430~1600)
- SFC (1630~1800)

▶ 29th Oct.
- WWW (0900~1300)

※ switch layout for
Welcome cocktail party after
2PM



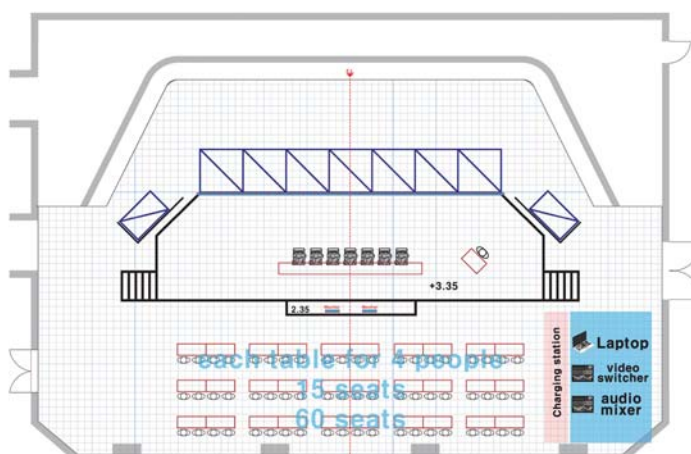
KBS TS-1

▶ About 120 participants

▶ 28th Oct.
- TC (1330~1700)

▶ 29th Oct.
- TC (0900~1700)

미술기획안



▲TS-1_ 100명기준
무대 + 테이블연사 6~7명 / 옆에 연단1명



▲6층 대회의실 / 40명 참여

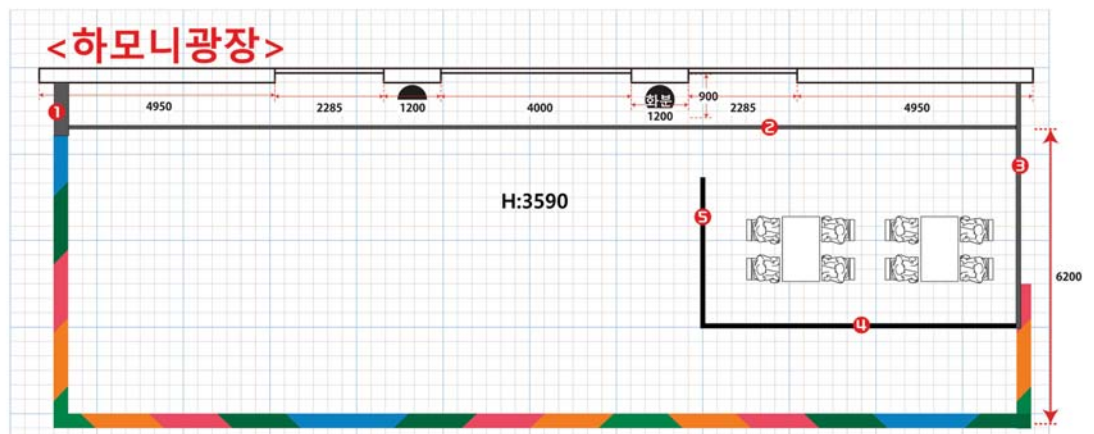
KBS Main Conference Room

- ▶ About 40 participants
- ▶ 28th Oct. : PSG (1500~1900)
- ▶ 29th Oct. : ACM (0900~1630)



KBS Harmony Square

- ▶ Technical Exhibition
- ▶ 27th Oct. ~ 29th Oct.





Conrad Hotel will serve as the prestigious venue for the first and second days of the General Assembly.

The renowned KBS Hall has been selected as a venue for the Associated Meetings and the stage for the spectacular TV Song Festival. ■



50
함께한 50년
여러분의 KBS

ABU 2023 SEOUL

60th ABU General Assembly and Associated Meetings

What Comes Next?

[Register Here](#)

KBS | Conrad Seoul 2023.10.28 Sat - 11.1 Wed



Technical Committee Meeting

28.10.2023 – 13:30-17:00 & 29.10.2023 – 9:00-17:00

ABU 2023
SEOUL



PROGRAMME (DRAFT)

VENUE: KBS TS-1, SEOUL

DAY 1 : 28 OCTOBER 2023, SATURDAY

TC PROCEEDINGS

- 13:30-14:00 **Welcome Address**
Hamid Dehghan Nayeri, Chairman, ABU Technical Committee and Director, International Technical Affairs & ABU Technical Liaison Officer, IRIB-Iran
- Welcome Address from the Host**
Kim Byung Guk, Executive Managing Director, Technology Division, KBS-Korea
- Opening Address**
Ahmed Nadeem, Secretary-General, ABU

ABU ENGINEERING AWARDS 2023

- 14:00-14:30 **Announcement of Winners of the Annual ABU Engineering Awards and Technical Review Prizes 2023**

KEYNOTE PRESENTATION

- 14:30-15:00 **Emerging Technologies for Future Public Media**
Masakazu Iwaki, Executive Research Engineer, NHK-STRL, Japan

- 15:00-15:30 *BREAK: Tea, coffee & networking*

TC PROCEEDINGS

- 15:30-16:00 **Confirmation of the Agenda and TC-2022 Proceedings and Appointment of Rapporteurs**
ABU Technology Activity Report
Bureau Proposals (Introduction)

THE HOST PRESENTS

- 16:00-17:00 **Moderator:** Cho Sung Rae, Director of Technology Management, KBS Technology Division, KBSKorea and Honorary Vice-Chairman, ABU Technical Committee
- AI-powered production: less repetitive, more creative**
Lee Yoon Jae, Deputy Manager (Team Leader), KBS Media Technical Research Institute, Korea
- The Role and Efforts of Korea for Broadcasting Development in the Asia-Pacific Region**
Joonam Lee, Deputy General Manager, Radio Wave & Broadcasting Industry Strategy Division, Korea Radio Promotion Association (RAPA)
- End of TC Day 1*

DAY 2 : 29 OCTOBER 2023, SUNDAY

TOPIC AREA REPORTS

- 09:00-09:40 **Production**
Kazim Pektaş, Chief Engineer, Studio Planning Department, TRT-Türkiye
- Distribution**
Yuji Nagata, Expert Engineer, Engineering Administration Department, NHK-Japan
- Spectrum**
Dr Li Leilei, Professor, Academy of Broadcasting Planning, NRTA-China
- Training & Services**
P. Das, Advisor, Doordarshan, Prasar Bharati-India
- 09:40-10:15 **Information Exchange and Status Reports**

- 10:15-10:30 **Bureau Proposals (Final Reading)**

- 10:30-11:00 *BREAK: Tea, coffee & networking*

ELECTION OF OFFICE BEARERS | ABU TC

- 11:00-12:30 **TC Elections**
- 12:30-13:30 *Networking lunch*

INVITED PRESENTATIONS | ADVANCEMENTS IN BROADCAST TECHNOLOGY & SERVICES

- 13:30-15:00 **Moderator:** Masashi Kamei, Senior Research Engineer, NHK STRL-Japan and Vice-Chairman, ABU Technical Committee

Technical perspectives of content exchange & media accessibility for hearing-impaired (tbc)

Hamid Dehghan Nayeri, Director, International Technical Affairs, IRIB-Iran

Lost in Transmission: Exploring the Pitfalls of Broadcast to Mobiles

Dr Peter Siebert, Adcom Member & VP, IEEE Broadcast Technology Society

Emergency Warnings: a co-operative approach to disaster alerting

Lindsay Cornell, Principal Systems Architect, BBC and Chairman, WorldDAB Technical Committee

Latest updates in DVB media delivery ecosystem (tbc)

Peter MacAvock, Chairman, DVB

- 15:00-15:30 *BREAK: Tea, coffee & networking*

INVITED PRESENTATIONS | LATEST TECHNOLOGY IMPLEMENTATIONS & USE CASES

- 15:30-16:30 **Moderator:** Kazim Pektaş, Chief Engineer, Studio Planning Department, TRT-Türkiye and Vice-Chairman, ABU Technical Committee

Developments in the digital space - An ABC case study (tbc)

Joel Brydon, Head of Digital Product, ABC-Australia

Asia-Pacific Going Big on DRM Digital Radio

Alexander Zink, Vice Chairman DRM Consortium and Chief Business Development Manager, Fraunhofer IIS

Beijing Winter Olympics 8K UHD TV International Public Signal Production

Mei Jianping, Director, Data Application Department, China Media Group, China

Broadcast, Content Distribution & Media Solutions

Ina Lui, Senior Vice President, Commercial, Business Development and Strategy, AsiaSat

MEMBER UPDATES & CLOSING

- 16:30-17:00 **New Members and Updates from Sister Unions & Intl Organisations**

Future Meetings

ABU DBS 2024, Kuala Lumpur, 4-7 March 2024

Appointment of Honorary Vice-Chairman from the host of the 2024 ABU General Assembly

Closing remarks by TC Chairman

- 18:00-18:45 **Welcome Cocktail Party @ KBS Hall**

- 19:30-21:30 **ABU TV Song Festival @ KBS Hall** ■



INTERVIEW WITH KBS'S EXECUTIVE MANAGING DIRECTOR (TECHNOLOGY), KIM BYUNG-KOOK

Korean Broadcasting System (KBS) is the host of the 2023 ABU General Assembly in Korea and Executive Managing Director of Technology Division at the Public Broadcaster, **Kim Byung-kook**, speaks to the Technical Review about KBS's contribution to development of broadcasting and current activities, issues facing broadcasters etc.

KBS WILL BE HOSTING THE NEXT ABU GENERAL ASSEMBLY. COULD YOU SHARE WITH US AS THE HOST WHAT YOU HAVE TO SHOWCASE TO ABU MEMBERS?

It is a great honour for KBS to host the ABU General Assembly, which marks the 50th anniversary of KBS. We also welcome all ABU members to attend this event in Seoul. During the two days of the Technical Committee on 28 and 29 October, a small exhibition stand will be set up near the conference hall to showcase KBS technology, hoping to provide a venue for diverse perspectives on the current broadcasting industry. I hope that the presentation of many prominent speakers at the Technical Committee meeting will be a useful opportunity for attending TC members to understand the latest technology trends.

HOW DO YOU SEE THE CURRENT SITUATION OF THE BROADCASTING INDUSTRY?

In 2012, Korea successfully completed the digital transformation of terrestrial broadcasting. The broadcasting landscape since then has undergone rapid change and the Internet and IT technologies are at the forefront. The proliferation of smartphones and the commercialisation of OTT services including Netflix and Disney+ have also fundamentally changed the way people consume content. This transition poses a considerable challenge to the terrestrial broadcasting sector. Nonetheless, it could also represent a chance for the broadcasting industry to enhance its production methods by leveraging IT technology.

HOW WILL KBS DEAL WITH THIS SITUATION?

I believe that new opportunities can only be created if the development of broadcasting and media technology can be incorporated into the production and distribution process. KBS recently launched its mobile service 'KBS+'. KBS+ is the only OTT app among Korean local broadcasters that allows users to consume content for free, providing real-time broadcast and replay services for five channels of KBS 1,2 TV and KBS N and 50,000 dramas, entertainment and current affairs content. In this way, we have created a free OTT app so that all users, including children, the elderly and the disabled, can easily enjoy KBS content. And with the help of vVERTIGO, an AI-based video editing solution, KBS content is produced as vertical videos on smartphones and is loved by many fans via YouTube.

We are also experimenting with various services using the nationwide broadcasting network, the largest asset of terrestrial broadcasters. The terrestrial broadcasting network is a free universal medium that can provide various data services in addition to broadcasting and has an advantage in terms of stability and economy over the telecommunications network, which is a paid service. KBS is striving to expand publicity and free universal viewing rights through the use of terrestrial broadcasting networks, such as disaster warning services using ATSC 3.0 technology, terrestrial MMS (Multi Mode Service) and UHD direct mobile reception services.

COULD YOU TELL US THE CURRENT STATUS OF UHD BROADCASTING AND ADOPTION OF AI IN KOREA?

As of 2023, the introduction of UHD broadcasting is expanding at the city and country level, and the organisation ratio of UHD broadcasting is 25%. The organisation ratio will be expanded to 50% by 2025. Additional services using ATSC3.0 technology are also

in pilot service or research and development. KBS has developed vVERTIGO, an editing tool using AI technology, and is using it to automatically cut individual images of characters. vVERTIGO has an exhibition booth for you to experience when you visit our KBS. Please look forward to it.

WHAT OTHER TECHNOLOGIES IS KBS PREPARING OR PLANNING TO APPLY?

KBS has recently implemented an XR system using LED video walls. This is set to revolutionise content production by ensuring high quality results regardless of location or time constraints. This XR facility has been integrated into KBS' facility tour programme, giving ABU General Assembly attendees the opportunity to visit and experience first-hand how it is being used for broadcast purposes.

HOW IS PUBLIC BROADCASTER KBS RESPONDING TO RAPID CLIMATE CHANGE AND DISASTERS?

KBS serves as the nation's primary broadcaster for disaster events through its Disaster Media Center. In addition, we have identified key initiatives such as "Strengthening Disaster Related Programmes" and "Improving Disaster Broadcasting Systems". These efforts include various detailed projects such as producing content on the climate crisis, carbon neutrality, energy and environmental issues throughout the year. KBS is also actively working to become a national disaster broadcasting centre by implementing proactive and distinctive disaster broadcasting strategies.

To enhance its capabilities and fulfil its public responsibilities, KBS conducts disaster broadcasting simulation training and education across all departments and business units. In addition, KBS has established an integrated system for anticipating seasonal disasters, enabling the sharing of disaster broadcasting plans between headquarters and local broadcasters, and we have expanded the resources available for disaster-related content, including the use of nationwide CCTV footage. For the safety of foreigners living in Korea, KBS also provides English scrolling subtitles on TV screens to convey important disaster information.

FROM A TECHNICAL PERSPECTIVE, WHAT IS THE VIEW OF KBS TO CONTRIBUTE TO ABU ACTIVITIES IN THE FUTURE?

KBS is committed to enhancing its future engagement in ABU activities, with a focus on technical advancements. KBS participates in ABU events every year, including the ABU DBS (Digital Broadcasting Symposium), where our experts present research findings and real-world applications. Additionally, KBS provides technical data and insights to ABU Technical Review on a regular basis. KBS is dedicated to actively supporting and collaborating

with ABU on its various initiatives and projects. We plan to make further contributions to enhance the technical aspects of broadcasting within the ABU community.

FINALLY, PLEASE SEND A MESSAGE TO THE TECHNICAL MEMBERS OF ABU.

In the constantly evolving broadcasting industry, change can often feel overwhelming. Nevertheless, it is during these periods of swift transformation that the collective knowledge and insight of ABU's esteemed technical members take centre stage. What might seem like challenges today could actually pave the way for new and stimulating opportunities for everyone. As the Technical Committee meeting approaches, I look forward to the innovative solutions that will emerge from our discussions. By working together, I am certain we can effectively navigate these changes and advance the broadcasting industry.

I welcome each and every one of you to join us in KBS, Seoul for the ABU General Assembly. This gathering promises to be a valuable chance for knowledge sharing and collaboration. I look forward to meeting you all in Seoul, where together we can shape the future of broadcasting through our expertise and shared vision.

KIM BYUNG-KOOK'S PROFILE

Kim Byung-kook joined KBS in 1989. He has worked in the field of broadcasting production and network for over 30 years. He has also served as Managing Director of the Broadcasting Network and Head of the Association for Terrestrial UHD Promotion in Korea, making significant contributions to the launch of UHD broadcasting in the country. He currently holds the position of Executive Managing Director of the Technology Division at KBS, where his responsibilities include the establishment of technology policy, broadcast technology research and terrestrial broadcasting. ■

News from the ABU Region

INFORMATION MINISTER PERFORMS GROUNDBREAKING OF PBC'S DIGITAL TRANSMITTER IN RAWAT PAKISTA

Radio Pakistan is launching a Digital Medium Wave Transmitter project in Rawat. The Minister for Information and Broadcasting Marriyum Aurangzeb performed the groundbreaking of the project under which a 1000-kilowatt digital transmitter will be installed at HPT complex, Rawat. The project will be completed in two years at a cost of four billion rupees and is a milestone in modernizing the state broadcaster and enhancing the quality of its broadcast.

This digital transmitter will increase the signal strength and range of Radio Pakistan's broadcasts to several countries in Central Asia, Middle East, Far East, Turkiye and Greece in addition to south Asia. This modern transmitter based on Digital Radio Mondiale (DRM) technology, can transmit up to four different signals simultaneously. It will save 33 percent of electricity which in turn will reduce the expenses of the state broadcaster.

An emergency warning system to alert people in natural calamities will also be available through this transmitter. UK based international organization DRM Consortium has also appreciated the government's initiative to convert Radio Pakistan from analogue to digital mode after 75 years. [Radio Pakistan]

THAI PBS ADDS 4K CONTENT CAPABILITY LEVERAGING ROSS VIDEO SWITCHERS

When Thai PBS recently decided to upgrade its two main studios to include the ability to create content in 4K and make major improvements to its existing HD studio, the Thai

public broadcaster chose two new production switchers from Ross Video. The new Ross Video switchers are used for the primary production of Thai PBS' live content at its broadcast facility headquarters in central Bangkok. The main objective of these upgrades was to enable Thai PBS' studios to create better quality content and ensure that they would be able to increase capacity in the future.

Thai PBS was also looking for production workflow flexibility that would allow for different types of technology such as SDI or IP. Having used the Ross Carbonite switcher in the past, Thai PBS chose Ross' flagship Acuity production switcher with a 4 M/E row and the Acuity control surface for its main studio upgrade. The company also selected Ross' Hyperconverged production platform, the 4ME Ultrix Acuity 4K / UHD switcher, with a 4ME row Acuity panel configuration.

Ross delivered the switchers to Thai PBS in March 2023 and the installation process was completed in April. Commissioning and training were done shortly after installation, with the switchers going live in May in time for the 2023 Thailand General Election. The Acuity and Ultrix Acuity production switchers have provided Thai PBS with a reliable, future-proof solution for news content creation that adds value and confidence to its creative staff, according to the broadcaster.

The switchers have already allowed the Thai PBS production team to greatly improve their creativity and storytelling capabilities. The team was already familiar with Ross production switchers and control surfaces thanks to a recent installation for its World News brand

and this made it easier for them to install and adapt to the larger and more powerful Acuity series. With state-of-the-art connectivity, the new Ross Video Hyperconverged switchers have also enabled integration with Thai PBS' existing automation system for a smoother and more efficient workflow. [APB News]

TVU NETWORKS CHOSEN BY MEDIACORP FOR LIVE REMOTE COVERAGE OF 32nd SEA GAMES

Singapore's largest content creator and national media network, Mediacorp, has once again chosen various TVU solutions to broadcast the 2023 Southeast Asian Games across its suite of TV channels, radio stations and digital platforms. The 32nd Southeast Asian Games kicked off in Phnom Penh, the capital of Cambodia, on May 5, 2023, which attracted more than 7,000 athletes from 11 countries within the region to compete for 5,151 medals in 37 competitive events. Mediacorp's coverage of the 32nd SEA Games follows its recent multi-platform offerings of major sporting events as part of its commitment to rally audiences behind Team Singapore.

Based on the network's experience in prior SEA Games, it turned to TVU Remote Commentator for the remote production required in their workflow. In addition to the remote commentary setup similar to the prior SEA Games, Mediacorp expanded TVU's role to include the collection and feedback of live scenes – using the TVU One cellular mobile transmitter and TVU Anywhere live streaming app.

During the 2023 SEA Games, Mediacorp successfully conducted remote live broadcast production and commentary production of football games, aquatic sports, track and field, martial arts and many other events through this combination of TVU solutions. TVU One and TVU Anywhere were deployed at multiple event sites to capture real-time images and fed back to the IBC (International Broadcast Center) for live broadcast and commentary production. Commentators in Ireland and Singapore watched the live

event video through TVU Remote Commentator, simultaneously conducting remote single-person commentary or multi-commentator, interactive commentary. The TVU Anywhere streaming app and TVU One mobile transmitter aggregated 3G/4G/LTE /5G connections and available Wi-Fi for high-definition wireless video transmission using TVU's patented IS+ technology, as well as FEC forward error correction, and HEVC intelligent VBR encoding to achieve stable feedback of audio and video signals for the live broadcast.

Using TVU's unique TimeLock technology, TVU Remote Commentator ensured the precise synchronization of audio and video signals from different locations, enabling accurate live commentary and interaction between on-air talent. In addition, the TVU cloud-based tuning microservice made audio operations simpler for Mediacorp. TVU's flexible microservices provided support for multiple languages, commentators, and viewer distribution platforms, such as broadcast TV, streaming, and social media platforms. The TVU remote production ecosystem provided Mediacorp with a precise and cost-efficient workflow for live video that enabled Mediacorp to enhance its international commentary talent pool. [tvunetworks.com]

IMAGINE SUREFIRE VIDEO AD SERVER LAUNCHES IN AWS SOLUTIONS LIBRARY

Imagine Communications, a global leader in advertising and media software and solutions, announces that its SureFire™ video ad server is now available in the Amazon Web Services (AWS) Solutions Library. A broadcast-quality ad decisioning solution for OTT, SureFire leverages an advanced set of broadcast rules and audience data across CTV, FAST, AVOD, and addressable linear platforms, enabling media companies to sell and fulfill campaigns across their entire audience and deliver a consistent, quality experience for both viewers and advertisers.

The AWS Solutions Library enables

customers to easily browse curated solutions built by AWS and AWS Partners for a broad range of industry and technology use cases. Whether organizations prefer off-the-shelf deployments or customizable architectures, the AWS Solutions Library enables fast discovery of AWS-vetted solutions and guidance that help rapidly address relevant business challenges.

SureFire operates as a managed cloud service on AWS, so it has flexibility and scale to meet the needs of any media company. Auto-scaling enables SureFire to support millions of concurrent viewers, with sub-100ms response times and six 9s reliability even under heavy load. It uses the advertising industry-standard VAST and VMAP protocols to communicate broadcast-quality dynamic ad insertion instructions with AWS Elemental MediaTailor.

Earlier this year, SureFire successfully completed the AWS Foundational Technical Review (FTR), which was part of the technical compliance step required for launch in the AWS Solutions Library. The AWS FTR is an added layer of clear understanding around technical and security evaluation, which in turn allows the products to be sold and supported in AWS Marketplace, a digital catalog with thousands of software listings from independent software vendors that make it easy to find, test, buy, and deploy software that runs on AWS. [Imagine Communications]

TELSTRA ANNOUNCES AGREEMENT WITH STARLINK

Telstra has announced it has signed an agreement to become the first provider in the world to offer voice-only and voice plus broadband powered by Starlink to rural and remote Telstra customers in Australia. Telstra CEO Vicki Brady stated that the Starlink agreement was part of Telstra's T25 strategy commitment to launch a satellite product with the voice and broadband options available to consumer and business customers.

Additionally, this agreement will offer connectivity options for our business

customers in Australia and overseas, as a higher bandwidth business-grade option in areas without fixed and mobile connectivity. Telstra will announce pricing and device details closer to the launch, which is expected to be in late 2023.

Telstra currently utilises a variety of technologies to provide voice and broadband services in rural and remote Australia, including nbn Fixed Wireless, Telstra's own world-leading mobile network and older copper and radio networks. Starlink will supply an additional connectivity option for individuals and businesses in rural and remote locations where distance and terrain pose challenges for existing networks.

One of the benefits of LEO satellites is their proximity to Earth, which enables them to send and receive signals much faster. This makes them an excellent option for services that require low-latency, like voice and video calls or providing backhaul to mobile networks. [C+T]

NEW TVRI WORLD CHANNEL LAUNCHES ON SES'S PRIME TV NEIGHBOURHOODS

TVRI, an Indonesian public broadcaster, in collaboration with PT Telkom Indonesia and its subsidiary Telkomsat, announced a high-definition (HD) channel, TVRI World, delivered to TV homes via SES's satellites. The English-language TVRI World channel is broadcast across Europe via ASTRA 19.2 degrees East and the Middle East via YahSat 52.5 degrees East.

As part of the agreement, SES is providing a full end-to-end service for the distribution of TVRI World, including playout services with content replacement, encoding, content delivery as well as monitoring.

Based in Jakarta, TVRI World builds on TVRI's legacy of high-quality programming about Indonesia by creating a global broadcast platform with news and information for Indonesians living abroad while also promoting tourism and economic development. [ses.com]

MALAYSIA'S TONTON GOES OTT WITH SWITCH MEDIA'S MEDIAHQ

Switch Media, the provider of online content delivery solutions, has announced that Malaysia's first and largest video streaming network Tonton, owned and operated by media powerhouse Media Prima, is using its MediaHQ online content publishing platform to create Tonton's integrated, dynamic new OTT service.

Media Prima owns and operates a wide range of media outlets, including: four national broadcasted TV stations, including the nation's number one free to air channel: TV3. Complemented by five national radio stations, three national newspapers, an out of home network and Malaysia's widest-reaching digital content platforms. Tonton, which is very well known across the country, originally launched back in 2010 and has been through several iterations since as the service it provides, and the market it serves, has evolved. International OTT services have since entered the market, but local content still remains the nation's most beloved genre, and Media Prima continues to be one of the genre's biggest producers of content.

MediaHQ benefits from a powerful workflow engine and houses an advanced suite of modular capabilities that are flexible and easy to integrate. From ingest, media management and preparation to distribution and analytics, customers have access to everything they need under one roof. The AVOD service, which launched in November 2022, was initially available on the Web, as well as on mobile apps for Android and iOS for smartphones and tablets with display and in-stream ads. This service carries a collection of Media Prima's market-leading free-to-air channels. This March saw the launch of its SVOD service, home to a range of premium international content, as well as local content, providing a broad selection of content for viewers. Switch Media has also now rolled out these services to Android TV and Smart TVs. [\[Content+Technology\]](#)

THE ABC EXPANDS AUDIO DESCRIPTION SERVICE TO ABC IVIEW

The ABC announced the expansion of audio descriptions to ABC iView, enabling audiences who are blind or have low vision to enjoy their favourite on-demand shows, movies and news in a more inclusive way. Audio descriptions provide a richer and more immersive experience by offering auditory narrations of visual elements during programming. With the allocation of dedicated funding in 2020, the ABC launched an audio description service across the broadcast television network. Since then, this commitment has been vital for audiences who are blind or have low vision. In the 2021-22 financial year, the ABC broadcast 1260 hours of unique audio-description content including many premiere events or first-possible releases, across broadcast multi-channels.

The audio description service was launched on ABC iView where more than 100 titles (over 1000 hours of audio described content) are available across iOS (iPhone/iPad), Chromecast and Android devices making programs such as Bluey, Fisk, Muster Dogs, Four Corners, Australian Story, The Newsreader and Mystery Road more accessible to more Australians. In the last budget, ongoing money for audio description services was incorporated in the ABC base funding. The ABC welcomes the bipartisan support that has allowed it to provide and expand audio description services.

According to the latest ABC and SBS Audio Description survey, 95% of people who are blind or have low vision are engaging with video every day or most days. One in three people who are blind or have low vision are engaging with content with audio descriptions. [\[ABC News\]](#)

NEPAL'S NTV GOES REGIONAL IN HD WITH ASIASAT

Nepal Television (NTV), Nepal's state broadcaster, has selected AsiaSat 7 to distribute a bouquet of five High Definition (HD) Nepali channels to serve audiences both nationally

and across Asia and Oceania, as announced by Asia Satellite Telecommunications Co. Ltd.

The five television channels, which are free-to-air, include general entertainment channels 'NTV' and 'NTV Plus', and news channels 'NTV News', 'NTV Kohalpur' and 'NTV Itahari'.

This collaboration marks a major milestone in AsiaSat's extension of broadcast services in Nepal. The high-powered coverage of AsiaSat 7 will support NTV's service expansion in the remote mountainous regions, demonstrating the power of satellite in connecting the unconnected with a variety of top-watched entertainment programmes, timely news and information. NTV can also leverage AsiaSat 7's strongest South Asian channel neighbourhood and exceptional audience access to reach out to overseas audience including millions of Nepali people working and residing across the region.

[\[Content+Technology\]](#)

DIGITAL RADIO MONDIALE DRM ENDORSED BY CHINA FOR DOMESTIC AM BAND BROADCASTS

The Digital Radio Mondiale™ (DRM) Consortium welcomes the recent announcement by key Chinese authorities to encourage the adoption of DRM for AM domestically and to get provincial transmission stations to broadcast DRM services.

The National Radio and Television Administration (NRTA), the Ministry of Industry and Information Technology (MIIT), and the State Administration for Market Regulation (SAMR) recommend the further strengthening of in-vehicle audio and video radio broadcast reception, as an essential component of the country's basic public services. The Chinese authorities also express the intention to accelerate the construction of digital radio broadcasting coverage networks with digital AM broadcasting (DRM) transmission systems at local transmission stations.

The aim is to finally build an advanced, fast-transmitting, and reliable digital radio broadcasting coverage network, able to improve the transmission quantity and signal quality of public service programmes available to the listeners. The process of transition from analogue to digital will be gradual and planned in stages. [DRM]

ASTRO AND AMAGI LAUNCH FREE AD-SUPPORTED STREAMING TV SERVICE ON SOOKA

Amagi, the global leader in cloud-based SaaS technology for broadcast and connected TV announced its partnership with Malaysia's leading media and entertainment company - Astro - to support the launch of Free Ad-supported Streaming TV (FAST) services on sooka, Astro's standalone streaming service for millennials. The service will host local content, live sports and a collection of specially curated global content acquired through Amagi's end-to-end content marketplace - Amagi CONNECT.

Astro's entry into the world of FAST marks a transformative shift in the Asian content market, as the renowned Pay TV and subscription-based streaming provider through its standalone streaming app, sooka embraces digital ad-based content consumption. sooka currently has 3.5 million app downloads driven by LIVE sports such as the Premier League and Liga Malaysia in addition to various local entertainment content and LIVE signature shows such as Kau vs Aku, Gegar Vaganza, Andai Itu Takdirnya and Derhaka Sebuah Cinta.

Amagi provides a complete suite of solutions for channel creation, distribution, and monetization. Amagi's global clients include ABCN, AccuWeather, A+E Networks UK, beIN Sports, Cineverse, Cox Media Group, Crackle Plus, Fremantle, Gannett, Gusto TV, NBC Universal, PAC-12, Tastemade, and The Roku Channel, among others. [Astro news]

QVEST EXPANDS GLOBAL PRESENCE WITH ACQUISITION OF TM STAGETEC SYSTEMS IN AUSTRALIA

Qvest has strengthened its position in Australia and New Zealand through the integration of tm stagetec systems. With the new Qvest Australia hub, the company can now offer all global Qvest Group practices in this region as well. Customers of Qvest thus have access to an even broader range of offerings to meet the challenges of their digital transformation and remain competitive in the information, communications, and technology industry.

With the acquisition of the Australian specialist in the ICT sector, Qvest expands its portfolio on a global scale and underlines the expertise in consulting and system integration in the media and entertainment sector. The integration of tm stagetec is a consequent step for Qvest after already several successful customer projects in Australia. With the establishment of the new regional hub Qvest Australia, customers will benefit from a more comprehensive local support network offering fast and effective solutions for their technological needs. [Content+Technology]

SBS UNVEILS BOLD REFRESH OF ITS DIGITAL HOME

In a global media first and a game-changer for multilingual audiences, SBS's new website can now publish in more than 60 languages across text, video and audio. SBS, Australia's distinctive, multiplatform, multilingual broadcaster, has revamped its digital home, unveiling the most significant redesign to its homepage in more than a decade.

Underpinned by a new platform, the new site better serves the needs of Australia's growing multilingual audiences, delivering breaking news, information, and compelling stories in a seamless user experience.

The new SBS.com.au strengthens the reach and discoverability of

the distinctive content for which SBS is renowned. The curated site showcases the network's unrivalled film, TV, news, audio, food and sport offering, with logical, user-friendly pathways to industry-leading streaming service, SBS On Demand, and its 15,000+ hours of content.

Made possible by a major technical overhaul, the site's redesign offers a first-rate user experience, featuring a scalable, and mobile-friendly interface that makes it easier than ever to consume great content, navigate across the network's platforms, and more quickly access relevant news and information, public service messaging, and compelling content about the sports, shows and movies they most enjoy. [SBS]

NEWTEK ADDS NINTH HEAVEN TECHNOLOGY AS NEWEST DISTRIBUTOR IN CHINA

NewTek, the leader in IP-based video technology, and part of Vizrt Group, announced the appointment of Ninth Heaven Technology as a new distributor in China.

This strategic partnership with Ninth Heaven Technology signifies a significant step towards expanding NewTek's presence in the growing Chinese proAV markets, including Enterprise, Education, Government, Esports, and more. NewTek recognizes the immense potential and importance of these markets and is dedicated to meeting the increasing demand for innovative video production solutions. The addition of a new distributor in China also reinforces NewTek's long-term commitment to delivering accessible, easy to use, yet cutting-edge solutions to customers and end users worldwide. [NewTek] ■

DIGITAL BROADCASTING *Updates*

IBC2023 BRINGS MEDIA AND ENTERTAINMENT WORLD TOGETHER TO PUSH NEW BOUNDARIES AND WIDEN INDUSTRY COLLABORATION

IBC announced that its IBC2023 show attracted 43,065 attendees from 170 countries at the RAI Amsterdam on 15th -18th September, celebrating business innovation and pushing new boundaries in media technology. With over 1,250 exhibitors and a 16% increase in total attendees, media leaders and technology pioneers from around the world gathered across bustling exhibition halls, buzzing networking events and packed theatres to define and action the future of media and entertainment.

With three core pillars running through the whole content programme at IBC2023 – Transformative Tech, Shifting Business Models and People & Purpose – IBC delivered its most comprehensive and compelling content agenda to date, tackling pivotal industry challenges and supporting M&E's mission to drive more sustainable and inclusive business practices. An increased line-up of 325+ speakers across an expanded number of theatre halls took to the stage to champion new technologies, future business models, and creative innovations that broaden the horizons of media and entertainment.

Topics such as cloud, AI, 5G, VR/AR/ XR, metaverse, gaming and edge computing were front and centre throughout the show floor theatres and exhibition halls, including proof-of-concept demonstrations delivered by the IBC Accelerator

Media Innovation Programme projects, championing cross-industry collaboration and pioneering new use cases. Introducing fresh show features and extending several exhibition halls – including opening Hall 3 – IBC2023 expanded its scope of media technology, launching an immersive Esports Showcase in partnership with Unlocked to present the latest innovation in esports production and delivery while industry experts explored key trends and opportunities at the intersection of gaming and media. The former Future Zone was revamped as the IBC Tech Zone powered by the EBU, showcasing cutting-edge technologies shaping the future of media experiences. [\[IBC News\]](#)

SEVERAL DVB SPECIFICATION UPDATES PLUS NEW SATELLITE COMMERCIAL REQUIREMENTS

The DVB Steering Board met at the end of June to round off a particularly intense and productive meeting cycle. In addition to the approval of an updated DVB-I specification and related implementation guidelines, previously reported, a raft of other documents were approved for publication.

DVB-RCS2 for non-geostationary satellites

The DVB-RCS2 standard – second-generation Return Channel Satellite – enables the provision of a variety of interactive services to consumers as well as professional and governmental users. With throughputs of up to 100 Mbps per user in the downstream, DVB-RCS2 has been used across multiple market segments around the world for more than a decade.

While DVB-RCS2 currently uses geostationary satellites, the recent launch of constellations of satellites into other orbits (so-called NGSO) using proprietary access schemes has reawakened interest in extending the features of DVB standards to enable their use in such systems. Commercial and governmental entities have expressed an interest in adding the necessary signalling and beam handover features needed for a DVB system to operate in LEO

or MEO (low or middle earth orbit) constellations and hence the original DVB-RCS2 commercial requirements have been extended (DVB BlueBook C107) to incorporate the necessary features.

In a related development, the Steering Board also approved the publication of DVB BlueBook A155-2r3, a revision of the lower layer specification for DVB-RCS2. The update adds references to satellite beam-hopping signalling. It will be forwarded to ETSI for publication as a new version of EN 301 545-2.

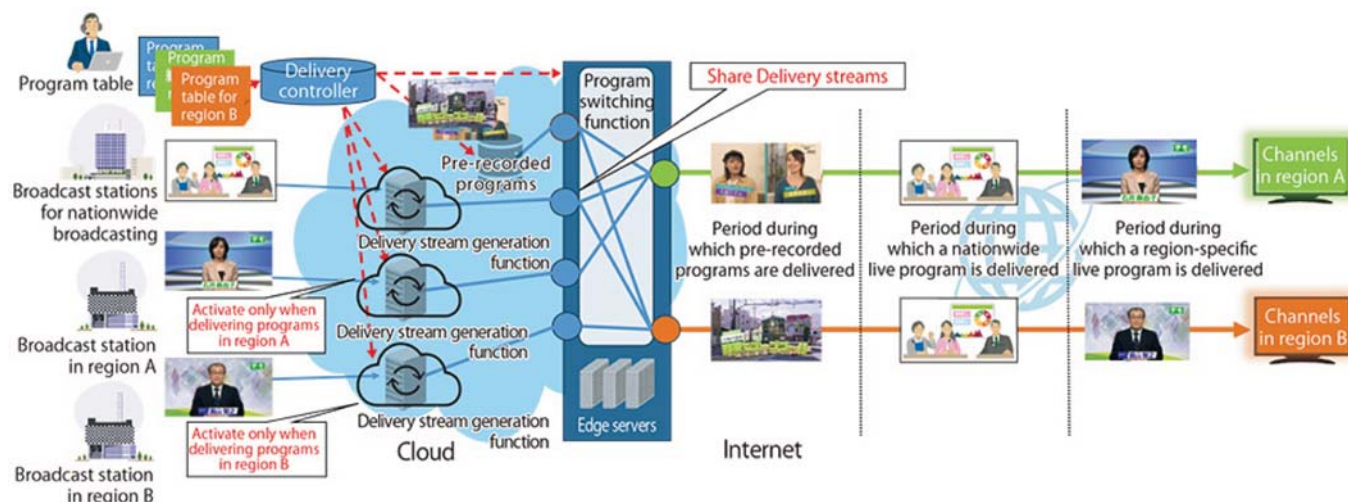
Other specification updates

Several other specification updates have been published as DVB BlueBooks following the recent meeting cycle.

An update to the DVB Targeted Advertising (DVB-TA) specification that deals with DVB-DASH streams (DVB-TA Part 3) adds the reporting of advert playback, an important capability for the tracking of advertising campaigns. The updated specification has been published as DVB BlueBook A178-3r1.

While verification and validation (V&V) work continues on the DVB Native IP (DVB-NIP) specification, an updated specification covers alignment with other relevant DVB specifications, as well as several bug fixes arising from feedback received during the V&V process. A revision of the original specification has been published as DVB BlueBook A180r1. (Related updates of the DVB Generic Stream Encapsulation (DVB-GSE) and DVB Multicast Adaptive Bitrate (DVB-MABR) specifications have also been published, addressing issues raised during the DVB-NIP V&V process.)

The DVB Home Broadcast (DVB-HB) specification has been updated with a device discovery mechanism based on multicast DNS and DNS service discovery. This update is intended to create alignment with DVB-NIP. It is published as DVB BlueBook A179r2. [\[DVB News\]](#)



STRL DEVELOPING EVENT-DRIVEN LINEAR CONTENT-DELIVERY SYSTEMS BASED ON PROGRAM TABLE

NHK STRL is researching platform technologies to meet a wide variety of needs for stable and efficient provision of broadcasters' internet video delivery services. Recent years have witnessed continuous growth in internet traffic and in the number of simultaneous connections to content-delivery services; to respond to these demands with flexibility, STRL is developing cloud-based delivery systems capable of utilizing servers, networks, and other infrastructure components on an as-needed basis.

STRL has developed a technology for stable and efficient provision of internet linear delivery services – in which program tables are used to deliver both live and pre-recorded programs, as in broadcast television systems – while reducing the burden placed on servers in the delivery platform.

Challenge of providing multiple linear delivery channels

Internet delivery systems offer the possibility of providing multiple linear delivery channels – combining programs and other content based on regions and viewer preferences – that can be more fine-grained than is possible via broadcast delivery. However, methods that offer delivery streams combining all programs from a given channel, as in broadcast systems, must continuously provide a large number of delivery streams according to the number of channels

and thus place heavy demands on the cloud-based infrastructure used to create those streams, posing challenges for stability and efficiency.

Developing an event-driven linear delivery system

STRL has developed a new delivery system that provides a large number of linear delivery channels stably and efficiently while making reduced demands on cloud infrastructure. This system aggregates programs in the cloud – including both pre-recorded programs and live programs transmitted in real time from broadcast studios and other sources – to create delivery streams for individual programs. Based on these streams, a delivery controller compiles program tables in accordance with the preferences of viewers and viewing regions, then an edge server – a delivery server that serves as the point of contact with display devices – switches program delivery streams one after another according to the program tables of individual display devices, to enable linear-delivery content viewing.

To reduce the demand placed on cloud systems, the delivery controller manages the system with an event-driven manner that activates the delivery stream generation function only when necessary based on the events such as the start and end of the live program. Also, at times in which the same program is delivered over channels in multiple regions – such as during nationwide broadcasts – the delivery stream is shared on those channels to increase delivery

efficiency. By using a reference time source to calibrate the timestamps of individual delivery streams, our system can achieve smooth switching between program streams without the image distortion or blackouts.

[NHK STRL]

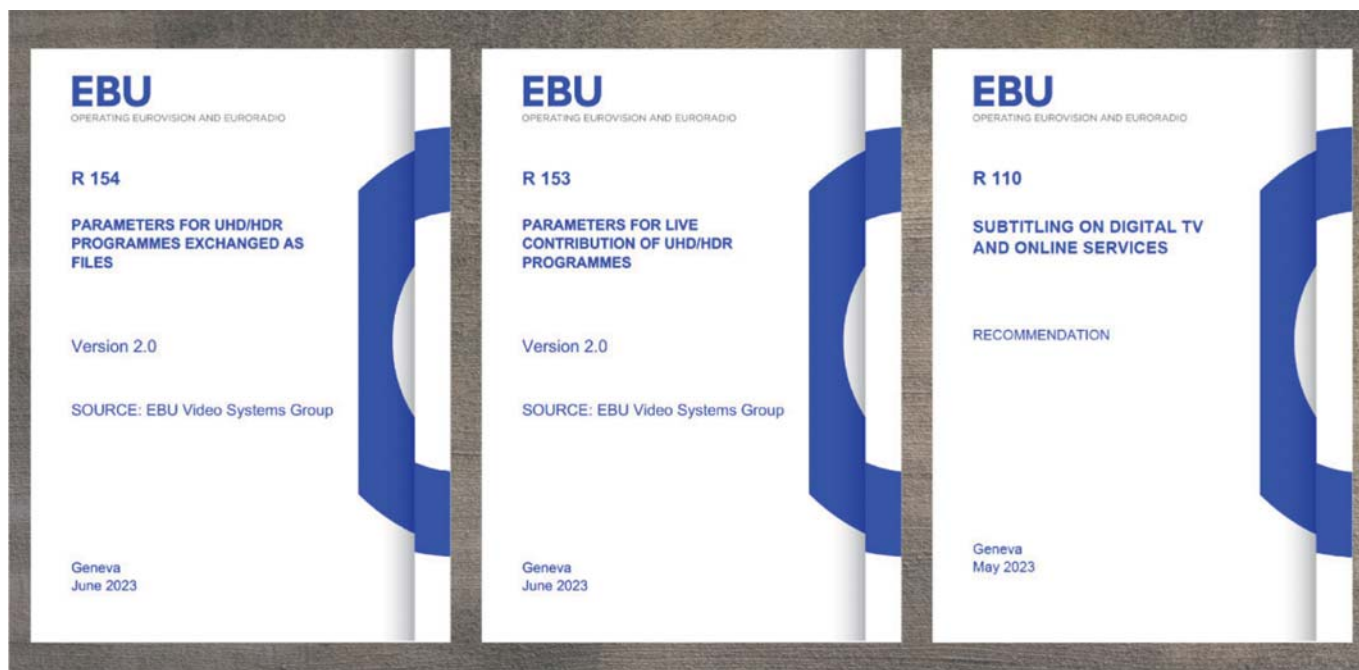
UPDATES TO EBU GUIDANCE ON UHD/HDR CONTENT EXCHANGE AND SUBTITLE DISTRIBUTION

The EBU UHDTV strategy group has updated the EBU Exchange Parameters for UHD/HDR programmes, both for live (EBU R 153) and file-based content (EBU R 154). The new versions are based on recent work from contributing EBU Members and are designed to be easier to use. Related work on distribution of subtitles has resulted in an update to another recommendation, EBU R 110.

Right from the outset of the UHD/HDR exchange parameters work, in 2021, it was agreed that the two recommendations would be updated based on operational feedback. Under the leadership of Karl Petermichl (ORF), this task was recently completed by specialists from several EBU Members.

What has changed?

The main changes for the live recommendation include the reference to the single-master HDR production workflow, as described in EBU Technical Report 070, the use of eight audio channels for channel-based audio production, and reference to EBU-TT/IMSC instead of EBU STL if subtitling is provided.



The file-based exchange parameters now recommend the use of XAVC MXF (or IMF where multiple versions are required), and the use of EBU-TT-D (EBU Tech 3380) for any subtitling. Readability of the audio section has been improved by clearly outlining two options: A) conventional audio, and B) metadata-guided audio.

The updated EBU recommendations are to facilitate content exchange between EBU Members, other broadcasters, service providers and production companies. The guidance is meant as a 'safe starting point', for use when no other agreements between two parties for UHDTV programme exchange are in place.

Subtitle distribution

While EBU R 153 and 154 focus on contribution, related work was recently completed by the EBU Timed Text group on distribution aspects of subtitling. An update to EBU R 110 means that it now recommends the use of IMSC Text Profile / EBU-TT-D to ensure compliance with the subtitling technology used on various distribution platforms (DVB-TTML, HbbTV, and DVB-DASH). [\[EBU News\]](#)

ATSC STANDARDS UPDATE: FOUR UPDATED STANDARDS PUBLISHED

Four updated documents have been published on the ATSC website. All are the result of changes approved by the TG3 Technology Group in

June and by the full Membership in August. The updated documents are:

A/331:2023-08, "Signaling, Delivery, Synchronization, and Error Protection."

This updated version includes the amendment, "MMT DRM." The amendment specified updated signaling in order to enable DRM over MMT, including out-of-order delivery, which is intended to decrease latency.

A/336:2023-08, "Content Recovery in Redistribution Scenarios."

This updated version includes the corrigendum, "CRC32 Specification." The corrigendum made edits to the message_CRC_32 and CRC_32 descriptions contained in Section 5.1.1 of the document.

A/360:2023-08, "ATSC 3.0 Security and Service Protection."

This updated version includes the amendment, "MMT DRM." The amendment updated A/360 to allow for DRM for MMT signaling in addition to DASH signaling, which is already supported.

A/72-3:2023-08, "Video and Transport Subsystem Characteristics of MVC for 3D-TV Broadcast in the ATSC Digital Television System."

This updated version includes the amendment, "A/53-3." The amendment changed the transport signaling from A/72-2 to A/53-3:2023-02. This change was

necessary because A/72-2 has been withdrawn. [\[ATSC News\]](#)

ASIA PACIFIC ONLINE VIDEO REVENUE TO SOAR OVER NEXT FIVE YEARS

Research from Media Partners Asia (MPA) has revealed good times ahead for its region's online video industry with 16% year-on-year growth in 2022 to reach US\$49.2 billion scaling potentially to US\$73 billion by 2027. The Asia Pacific Online Video & Broadband Distribution 2022 noted a number of key drivers of the market such as the growing availability of high-quality local content online with travelability - led by Korea, Japan, China, India, Thailand and Taiwan – and premium sports rights for the likes of football and cricket transitioning online in markets such as Australia, India, Indonesia, Korea, Singapore and Thailand. MPA also noted that "growth at any cost models" were fast transitioning towards more rational models, anchored to monetisable reach through telcos and organic, direct customer funnels.

The study forecasts online subscription video-on-demand (SVOD) will grow by 19% in 2022 to US\$24.6 billion in revenues with China contributing 51%. Apart from China, the Asia Pacific SVOD sector is set to grow revenues by 25% year-on-year to US\$12.0 billion in 2022. SVOD revenue is projected to reach

US\$19.1 billion by 2027 in APAC ex-China and US\$36.5 billion with China.

Advertising video-on-demand (AVOD) is forecast to generate US\$24.6 billion in 2022 in APAC, up 13% Y/Y. APAC ex-China drove US\$13.4 billion, up 24% Y/Y. YouTube leads with an estimated 42% share of the APAC ex-China AVOD market in 2022. AVOD is forecast to grow at an 8% CAGR over 2022-27 to reach US\$37.6 billion in APAC. APAC ex-China is projected to grow at a CAGR of 12% to reach US\$23.7 billion, while APAC ex-China UGC AVOD share is expected to reduce from 80% in 2022 to 76% in 2027 as the premium AVOD category, led by broadcaster video-on-demand platforms, expands.

Looking at the companies that will be driving the market, MPA noted that the top 20 online video platforms will account for two-thirds of total APAC online video revenue in 2022. Non-Chinese leading vendors include YouTube, Netflix, Amazon Prime Video, Disney+/Disney+ Hotstar, key local players in Japan, Korea, Australia and SEA such as Yahoo! Japan, TVer, Stan, Vidio and Viu. [\[Rapid TV News\]](#)

CONSUMERS IN INDIA & SOUTHEAST ASIA KEEN TO EMBRACE GENERATIVE AI

In the Asia-Pacific region, consumers in India and Southeast Asia are generally more active in embracing new digital experience formats, environments, and tools, compared to their counterparts in Australia, New Zealand, and Japan.

According to Adobe's Future of Digital Experiences Report, 81% of consumers in India expect more personalised and relevant digital experiences, given the data and technologies brands can access. These numbers contrast with 32% of consumers in Australia and New Zealand, and 13% in Japan.

These numbers parallel national consumer expectations that brands will offer new and innovative experiences. For example, 91%

of Indian consumers and 86% in Southeast Asia expect new ways for brands to engage in virtual or immersive worlds. The same is true for 60% of consumers in Australia and New Zealand, compared with just 48% in Japan.

Driving this new wave of consumer engagement is generative AI, with around nine in 10 consumers in India (93%) and Southeast Asia (89%) believing that generative AI can improve customers' experiences and product quality.

When it comes to leveraging generative AI, consumers are most excited for brands to help them better find things online (32%), make experiences more relevant and helpful (30%), and enhance the creativity of content they engage with (27%). [\[APB News\]](#)

DIGITAL TECHNOLOGIES DIRECTLY BENEFIT 70 PER CENT OF SDG TARGETS

More than two-thirds of the UN's targets for sustainable development can benefit directly from digital technologies, according to the International Telecommunication Union (ITU) and the United Nations Development Programme (UNDP), organizers of SDG Digital which opened at United Nations Headquarters in New York.

With digital technologies so closely linked to the Sustainable Development Goals (SDGs), the SDG Digital event highlights how safe, inclusive and scalable digital solutions can put the 2030 Agenda for Sustainable Development back on track amid concerns that the world may miss the vision for people, planet and prosperity that was set in 2015.

The SDG Digital Acceleration Agenda, a global analysis of the connections between digital technologies and sustainable development, was released as part of SDG Digital to provide a roadmap to governments on their digital transformation journey and to promote action and financing.

Uniting around digital to drive sustainable development

According to UN assessments, progress on half of the 169 SDG targets is either weak or insufficient at the 2030 Agenda's halfway point. Thirty per cent of the SDG targets have either stalled or gone in reverse. With digital transformation demanding joint efforts between the private sector, financial institutions, civil society, the UN, governments and young people, SDG Digital brings together experts, policy-makers and business leaders to explore the achievements, gaps and solutions on how digital technologies can support the 2030 Agenda.

Scale and innovation accelerate transformation

The SDG Digital Acceleration Agenda, developed by ITU and UNDP together with Boston Consulting Group (BCG) as knowledge partner, and the Inter-American Development Bank (IDB) as Agenda supporter, shows how digital technologies kickstart economic and societal transformation by creating scale and efficiencies. The Agenda features digital solutions that are already demonstrating how tech can directly benefit 119 of the 169 SDG targets, or about 70 per cent, including in areas such as climate action, education, hunger and poverty.

Data in the SDG Digital Acceleration Agenda suggest that countries which improved their digital maturity – as measured by digital affordability and infrastructure indices – outpaced their peers in SDG progress for selected income levels. The Agenda also profiles the opportunities for sustainable development offered by advancements such as generative AI, 5G networks, and blockchain.

Financing and joint action bring scale and innovation

Digital transformation requires considerable investment in connectivity infrastructure, building up digital skills, and creating the conditions for job retraining and new opportunities. SDG Digital highlights that the funding gap of over USD3.7 trillion for the SDGs should focus international efforts on

enablers – such as infrastructure and connectivity – as well as the pooling of resources through collaboration including the private sector and the utilization of diverse financing methods.

Digital public infrastructure as a catalyst for the SDGs

The formal opening of SDG Digital is part of the UN's SDG Action Weekend, a series of High Impact Initiatives focused on mobilizing further leadership and investment to bring progress to scale between now and 2030. This includes the UN High Impact Initiative on Digital Public Infrastructure to scale inclusive and open digital ecosystems for the SDGs.

The decisions by countries on how to build their digital public infrastructure (DPI) will have lasting consequences on their opportunity to grow and innovate, and to achieve the SDGs by 2030.

As highlighted in a recent G20 publication supported by UNDP, DPI – built on robust governance and strong local digital ecosystems – can deliver value and high impact across all of the 17 SDGs to leave no one behind.

Making connections means progress

Earlier in the week, ITU announced a decline in the number of people worldwide without a connection to the Internet to 2.6 billion people in 2023 from 2.7 billion in 2022. The statistic on the global offline population is important for tracking connectivity, a foundation of using technology for sustainable development. At the current trend, the global targets for universal and meaningful connectivity are unlikely to be met by 2030.

The SDG Digital event and the SDG Digital Acceleration Agenda are the joint contributions of ITU and UNDP to the UN's effort to bring stakeholders together at the SDG Action Weekend ahead of the SDG Summit and UN General Assembly High-Level Week. SDG Digital on-site participants include over 300 leaders

from government, civil society, industry, academia, and the UN system. [\[ITU News\]](#)

IDEAS AND OPPORTUNITIES TAKE CENTRE STAGE AT DVB WORLD 2023

With the event adopting the unconference format for the second year running, DVB World 2023 delivered an intense day of discussions on the future of media delivery in Brussels. Over 120 participants gathered on 22nd June, together building an agenda that covered a broad range of topics – 36 pitches leading to 27 sessions, running in parallel blocks throughout the day.

Session hosts were encouraged to be “output-oriented” as much as possible. This meant ensuring time was given to discussing the next steps that would move a topic forward. Almost every session report (available to DVB Members and event participants) defined such next steps, which will typically result in new requests back to the relevant DVB working groups, or further research or action by those involved in the discussions.

DVB-I dominant

DVB-I was among the most-discussed topics at the event, effectively becoming the subject of a conference within an unconference in a series of sessions. A general scene-setting overview of how the specification itself is evolving was followed by a session featuring updates from the trial and test activities in Italy, Germany and Ireland.

A session on service discovery and service lists was followed by one on accessibility features, and another on metadata preparation. The day was rounded off with a very fruitful discussion identifying barriers to DVB-I deployment and actions to drive momentum.

Progress on other DVB solutions

Another set of sessions focused on other existing DVB specifications and explored ways of increasing their deployment. Topics discussed included the extent to which DVB

Native IP might help broadcast operators close the gap on OTT services, effective ways of getting more UHD HDR (high dynamic range) content into homes, and the challenge of encouraging uptake of DVB's Targeted Advertising specifications.

There was also a session on how DVB-SIS (Single Illumination System) might gain more market traction if there were a renewed focus on verification and validation (V&V) as a means of easing deployment.

New technologies and trends

Wider industry trends inspired several sessions, with participants exploring where there might be some new standardization work for the DVB Project to undertake across a diverse range of topics. One session, for example, asked what might be needed beyond existing DRM (digital rights management) solutions for OTT content; another discussed whether open caching technology could have a role to play in DVB-MABR and DVB-NIP; and several other sessions looked at new user experience technologies such as film grain synthesis, haptics and volumetric video.

Other topics appearing on the agenda included sustainability – and specifically the contribution that “good enough content” and “good enough delivery” can make, as well as the potential conflict with the goal of resilience – and questions around fragmentation in global standards and the potential for finding more commonalities. [\[Rapid TV News\]](#) ■

Equipment Trends

DPA MICROPHONES, NEW 2017 SHOTGUN MICROPHONE

DPA Microphones, a renowned manufacturer of sophisticated



microphone technologies, presents the 2017 Shotgun Microphone. This microphone has been meticulously crafted to offer unmatched sound quality, directivity, and clarity, making it an exceptional choice for challenging broadcast scenarios. Designed to withstand intensive conditions, the 2017 model is apt for a wide range of applications, from broadcast and live events to news, sports, on-location sound recordings, and musical performances.

The 2017 model's design emphasizes durability against extreme weather and mechanical stresses. It showcases remarkable resilience, performing effectively in both humid and arid environments, and can operate efficiently in temperature extremes from 40°C (104°F) to a freezing -40°C (-40°F). This

microphone's notable moisture resistance ensures consistent sound quality, even in unpredictable weather conditions.

One of its key features includes a uniquely designed capsule, complemented by a state-of-the-art interference tube and microphone grid. This combination guarantees optimal performance in both direct and peripheral sound capture. The microphone's ability to suppress off-axis sounds ensures the primary audio source remains distinct, while also capturing genuine peripheral sounds, enhancing the overall sound profile. This makes it suitable for recording a spectrum of sounds, from subtle nuances to dominant audio elements.

Moreover, the 2017 model stands out for its versatility. While tailored for live sports and news broadcasts, it is equally effective in theatrical environments, outdoor audio recordings, and live musical events, promising a top-tier auditory experience for various settings.

<https://www.dpamicrophones.com/>



GRASS VALLEY, NEW KAYENNE PRODUCTION SWITCHER CONTROL SURFACES

Grass Valley has introduced enhanced production switcher bundles, specifically designed for applications in sports, entertainment, news, and other major global events.

In this new release, Grass Valley merges the reimagined Kayenne modular Video Production Center surfaces with the K-Frame XP video processing engines. This

amalgamation underlines Grass Valley's commitment to addressing the dynamic requirements of broadcasters and various media and entertainment organizations. The modernized Kayenne control surface modules maintain the attributes that operators have relied upon for years, while integrating contemporary upgrades.

These enhancements encompass touchscreen functionalities, improved tactile feedback for 8-keyer recall buttons, the introduction of new Panel Control and

Menu Control Units, and the adoption of standardized cabling. Such advancements are intended to set the stage for future user-centric operational innovations.

One of the standout features of these updated bundles is their cost-effectiveness, ensuring users access the renowned creative prowess associated with Grass Valley switchers, all while streamlining the processes for Technical Directors (TDs) and Engineers-in-Charge (EICs).

The Kayenne K-Frame XP bundles are tailored for larger-scale productions. However, Grass Valley's principle of "Any Surface, Any Engine" guarantees that panels, such as Korona and Karerra, can effortlessly collaborate with any K-Frame variant, be it the CXP, SXP, economical V-series, or the software-oriented switchers powered by AMPP. This strategy offers users unmatched flexibility and a strategic pathway for potential upgrades.

In addition, the K-Frame engines have been upgraded to accommodate a JPEG XS board, enabling sophisticated IP input and output setups based on user needs. This addition aligns well with the inherent JPEG-XS support present in the Grass Valley LDX 100 series cameras and the latest C135 compact camera model.

<https://www.grassvalley.com/>



VIZRT, TRICASTER MINI GO

Vizrt has unveiled an extended TriCaster range, subsequent to the recent integration of NewTek into the Vizrt suite of solutions.

To cater to a diverse range of content creators and video producers, Vizrt has launched an introductory TriCaster model and introduced cloud-based switcher capabilities with the TriCaster Mini Go.

The TriCaster Mini Go serves as Vizrt's foundational offering for streamers and content creators, aiming to elevate the quality of their video production. Key features of this model include USB, NDI, and SRT connectivity, with 4 input channels, 2 M/Es, and mix outputs operating at HD resolution.

The TriCaster Now provides users with the robust and reliable TriCaster software, which has been a staple in production suites, outdoor broadcasting vehicles, academic institutions, corporations, and various video production venues. Notably, this software operates independently of location-specific hardware.

This dynamic and adaptable on-demand production solution is cloud-based, integrating seamlessly with NDI, SRT, multiple IP technologies, and other cloud-based sources, facilitating streaming to any designated endpoint.

Notably, the entire system can be set up and operational in less than 10 minutes and can be deactivated post-use. This approach eliminates the need for users to maintain their own cloud infrastructure, thus yielding cost savings, reducing carbon footprint, and enhancing operational efficiency.

In alignment with TriCaster's commitment to providing comprehensive solutions for all stages of live production, the enterprise-level 4K cloud-based switcher,

formerly known as Viz Vector Plus, has been rebranded as TriCaster Vector.

TriCaster Vector is designed for deployment within a client's existing cloud infrastructure. Upcoming enhancements for this model include augmented bit-depth support, superior bitrate stream quality, and additional advanced features.

With the integration of these new offerings, Vizrt presents its clientele with two distinct cloud production avenues: the straightforward and standardized approach with TriCaster Now and the more tailored and robust solution with TriCaster Vector.

<https://www.vizrt.com/>

TSL, MPA1-MIX-NET-V-R, 1U AUDIO CONFIDENCE MONITOR AND MIXER

TSL is poised to launch the MPA1-MIX-NET-V-R, an advanced 1U audio confidence monitor and mixer. This device comes equipped with 16 independently recallable mixes, streamlining the transition to IP. Developed in line with the SMPTE ST 2022-7 industry standard, it optimizes network topologies, aiming to reduce network complexities and customer risks without sacrificing operational adaptability. As an established name in audio monitoring, TSL's MPA1-MIX-NET model is designed to counter potential system disruptions, ensuring broadcasters consistently deliver high-quality content, whether for major sporting events, live concerts, or other significant global events.

The shift towards IP is undeniable, and the industry's objective is to develop products

that seamlessly transition from the current systems to the upcoming IP-based platforms. These products should not only maintain familiar workflows but should also be entirely ready for a comprehensive IP environment. By integrating advanced redundancy capabilities, challenges can be addressed cost-effectively, emphasizing a client-centric approach. This strategy provides unparalleled IP solutions, ensuring continuous audio monitoring with utmost reliability.

About the MPA1-MIX-Net-V-R:

Designed to facilitate the transition to IP media transport, the MPA1-MIX-NET-V-R is ideally suited for ST 2110 setups. It features two 1G AoIP connections, providing 64 input channels, with an added 64 channels available through an optional MADI SFP. The device also supports in-band NMOS, allowing for seamless integration with both TSL controls and other major third-party systems.

User interfaces play a pivotal role in high-pressure production environments. Taking cues from insights provided by global production experts, the MPA1-MIX-NET's design incorporates a distinctive "V"-shaped control layout, ensuring precise navigation, especially in low-light situations. Additionally, the device offers SNMP integration, allowing for remote configuration modifications.

Key Features and Benefits:

- Supports a total of 128 channels, with 64 primary channels and an additional 64 via an optional MADI input, coupled with a user-centric interface.
- Provides eight dedicated rotary controls,



facilitating effortless monitoring of multiple audio sources and simplifying mix configurations.

- Fully compatible with modern Broadcast IP networks, granting operators easy access to any audio source.
- Comprehensive webpage and SNMP support enhance remote configuration and control capabilities.

Feedback from global technical production partners underscores the significance of user experience and sound quality in demanding production settings. The MPA1-MIX-NET's design, particularly its intuitive "V"-shaped front panel controls, is especially beneficial in high-paced environments, such as live production. The inclusion of ST 2022-7 network functionality is a notable advancement, and collaborations in the industry have led to enhanced remote configuration capabilities.

<https://www.tslproducts.com/>

VISLINK, WMT LIVELINK, CELLULAR TRANSMITTER



Vislink is set to introduce its latest bonded cellular transmitter, the WMT LiveLink. This advanced transmitter promises to revolutionize live remote production across various sectors, from news and sports to essential live events.

Incorporating the renowned Mobile Viewpoint technology favored by broadcasting experts globally, LiveLink's innovative design provides superior quality 4:2:2, 10-bit HEVC video encoding up to 4K resolutions. Additionally, it features 10-bit Luma Optimization to cater to HDR demands.

LiveLink allows broadcasters to benefit from premium, low-latency video transmissions. This is facilitated by FPGA technology and HEVC encoding, which enhances the quality and flow of interactive interviews.

A notable feature of LiveLink is its robust bonding connectivity, supporting multiple public cellular connections, WiFi, and public internet. Even in densely populated areas, users can maintain robust data connectivity, thanks to its integration with Vislink's proprietary 5G connectivity solution. Furthermore, with the inclusion of bonded cellular, private 5G, and Starlink satellite support, LiveLink ensures smooth

transitions across both private and public 5G networks.

For field camera operators, LiveLink offers a direct audio link that ensures constant communication with the central broadcast team. This is complemented by an integrated camera control feature. Additionally, its multi-camera/transmitter synchronization capability allows for fluid switching between live feeds, offering diverse viewing perspectives.

Despite its comprehensive features, LiveLink boasts a compact design, making it easily transportable. Its size is conducive for pairing with mirrorless camera systems or direct mounting on ENG camera equipment without affecting the device's balance or functionality.

Connectivity is further enhanced with LiveLink, as it provides an SFP slot, accommodating varied video inputs, HDMI support, and SDI video outputs. The inclusion of two Ethernet connections transforms the device into a data hotspot, facilitating remote control and Internet access.

Moreover, LiveLink seamlessly integrates with LinkMatrix, Vislink's browser-based management platform. This allows for remote management and control of LiveLink devices, streamlining broadcast production processes.

<https://www.vislink.com/>

HOLLYLAND, VENUSLIV

Hollyland has ventured into the livestream camera sector with VenusLiv, an innovative solution tailored for live shopping, online educational sessions, podcasting, and other intimate indoor live streaming ventures. VenusLiv amalgamates convenience, quality, and pioneering technology, offering an unparalleled live streaming experience without the intricacies of complicated equipment setup.

The rise in live streaming popularity has been significant globally, especially among small to medium-sized groups and individual users. However, establishing a top-notch live-streaming environment can

be both expensive and intricate. While professional DSLR cameras might be challenging for users lacking fundamental photography knowledge, smartphones often fall short in terms of image quality and adaptability. VenusLiv emerges as Hollyland's answer to these challenges.

Key Features of VenusLiv Include: Ease of Streaming with RTMP and UVC:

VenusLiv incorporates the Real-Time Messaging Protocol (RTMP), crucial for live broadcasting. This facilitates streaming across multiple platforms such as YouTube, Facebook, Instagram, Twitter, and more. RTMP is a premier communication technology optimized for internet-based live video streaming, ensuring low-latency and superior video and audio quality. Additionally, with its in-built USB video class (UVC) functionality, there's no requirement for an external capture card. Users can effortlessly connect VenusLiv to their computers using USB 3.0 and initiate streaming immediately.

Consistent Performance and Extended Streaming Duration:

VenusLiv stands out for its long-duration usage without overheating, attributed to its cutting-edge aerospace-grade heat dissipation mechanism. This guarantees continuous live streaming without performance disruptions or potential equipment damage. Additionally, with its dual charging options – DC and NP-F battery – VenusLiv supports non-stop 24/7 live streaming.

Swift Autofocus and Advanced Color Adjustments:

VenusLiv's hybrid autofocus employs phase and contrast methodologies to promptly focus on proximate objects, ensuring crisp and vivid images. Coupled with the efficient HollyOS system, users can effortlessly adjust focus and monitor frames to capture the desired shots. A distinctive feature of VenusLiv is its color tuning capability, allowing users to modify the on-screen persona's appearance without affecting other elements. This ensures an enhanced visual representation while maintaining the authenticity of products or objects.

<https://www.hollyland.com/> ■



ABU TECHNOLOGY CALENDAR *of Events* 2023

September 15-18

Amsterdam

International Broadcasting
Convention 2023

September 21

Online

Webinar on ICDN and Data
Clean Rooms in Media Industry

October 9-13

Tunis, Tunisia

ABU-ASBU Satellite Workshop

October 17

Online

ABU Technical Bureau Annual
Meeting

October 28-29

Seoul, Korea

ABU Technical Committee
Meeting

ABU 2023 SEOUL

October 28 - November 1

Seoul, Korea

60th ABU General Assembly

ABU 2023 SEOUL

November 12

Malaysia Holiday

Diwali Day



Public holidays falling on a Sunday are
recognised on the next working day.

November 21

Online

ABU-IEEE BTS Webinar on
Unlocking the Future of Video:
Adding Next Generation Video
Codecs to the DVB toolbox

December

Online

Engineering Fundamental
Training Course Level 3

December 25

Malaysia Holiday

Christmas Day!



The background of the poster features a large, stylized green world map in the center, composed of a grid of dots. This map is set against a circular backdrop with concentric green rings and radial lines, creating a globe-like effect. The overall color scheme is various shades of green.

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