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19-20 OCTOBER 2024

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Inside

Cover: ABU Technical Committee Meeting was held in istanbul, Türkiye

Asia-Pacific Broadcasting Union

from the Editor

As we celebrate the 300th edition of the ABU Technical Review, we take this opportunity to reflect on how far the industry has come and where it is headed. Broadcasting continues to evolve at an unprecedented pace, driven by innovations in AI, cloud technology, immersive media, and personalized content delivery. This issue explores some of the most significant advancements in these areas, offering insights into the technologies shaping the future of our industry.

The past months have been dynamic for the ABU Technology community. Our Technical Committee and Bureau Meetings in Istanbul brought together industry leaders to discuss the latest developments in broadcasting technology. From spectrum management to innovations in production and distribution, these discussions underscored the importance of strategic collaboration and knowledge-sharing. The reports in this issue highlight broadcasters' ongoing efforts across the region to tackle challenges while unlocking new opportunities in content creation and delivery.

One of the most transformative shifts in broadcasting today is the growing demand for tailored audience experiences. As viewers engage with content across multiple platforms, broadcasters must adopt technologies that enable personalization and interactivity. This is reflected in the theme of DBS: *"Personal-cast: Interactive broadcasting, tailored for you."*

The industry is moving beyond traditional broadcasting models toward AI-powered recommendation systems, interactive live experiences, and dynamic content adaptation. The ability to deliver media that is not only accessible but also engaging and personalized will be crucial to maintaining audience loyalty and relevance in the digital era.

As we navigate this transformation, collaboration remains vital. ABU continues to serve as a hub for innovation, bringing together broadcasters, technology providers, and researchers to explore new frontiers in media technology. Through initiatives like DBS, technical forums, and research-driven projects, we are shaping a future where broadcasting remains impactful, resilient, and forward-thinking.

A heartfelt thank you to all our contributors, partners, and readers who make this publication a platform for sharing knowledge and ideas. I invite you to explore the insights in this issue and join the conversation as we push the boundaries of broadcasting innovation.

Warm regards,
Dr Veysel Binbay
veysel@abu.org.my

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

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Dr Veysel Binbay
ABU Technology
The Asia-Pacific Broadcasting Union
2nd Floor, IPPTAR Building, Angkasapuri, 50614 Kuala Lumpur, Malaysia
Telephone: (60-3) 2282 3108 Fax: (60-3) 2282 5292

For advertising inquiries, contact
Nur Aqilah Mohd Izam email: aqilah@abu.org.my
Siti Balqis A Sudirman email: balqis@abu.org.my

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Koi Tropika, Block E-08, Jalan Puchong Batu 13 1/2, 47100 Puchong, Malaysia

APPLYING MACHINE LEARNING TO IMPROVE QUALITY IN DASH STREAM CONSIDERING VIDEO CONTENT COMPLEXITY

ABSTRACT

HTTP-based dynamic streaming, or DASH for short, is a video streaming standard that stores versions of video at different bitrates on the server, allowing users to request different bitrates for video chunks. A DASH-based streaming system uses ABR algorithms to determine the bitrate of each video chunk. ABR algorithms are among the tools used by content providers to improve the quality of user experience. These algorithms are applied on user-side video players or during the server-side streaming process and dynamically select the bitrate for each video chunk. In this research, ABR algorithms based on learning on the user side are focused. These algorithms automatically learn how to make bitrate decisions and operate without using any preprogrammed control rules or explicit assumptions about the environment. An important problem with most of these methods is the lack of attention to the complexity of the video content or VCC. Not paying attention to the complexity of the video content can reduce the quality of the user experience. In this research, by applying the complexity of video content along with reinforcement learning, it is tried to decrease deadline misses due to increase the quality of the user experience. MATLAB software has been used to simulate the test environment. The simulation results show that in the proposed method, using the complexity of video content along with reinforcement learning decreases the deadline misses.

KEYWORDS: Dynamic adaptive streaming; Video content complexity; Machine learning; QoE.

1. INTRODUCTION

Nowadays, due to the emergence of online video streaming services, such as Netflix, YouTube, and Hulu, people's desire to watch videos and TV programs in this way has increased. So, it is required that these video service providers face the challenges arisen by the increased number of video service consumers.

According to Cisco statistics, the amount of video traffic in 2022 was approximately 82% of the total internet traffic [1]. It worth to note that majority of this video traffic and the aforementioned video services are provided over the HTTP-based communications. So, this leads to the increment in the volume of HTTP-based video traffic. One of the important reasons for this increase in HTTP-based video traffic is the increase in the quality of video service provided by video service providers, which ultimately leads to an increase in the quality of users' experience (QoE). Therefore, in order to be successful in competing with other video services, video service providers must seek to increase the quality of video content broadcast day by day.

HTTP streaming systems use ABR algorithms. ABR algorithms are among the tools used by content providers to improve the quality of experience. These algorithms are mostly applied to client-side video players and dynamically select the bitrate for each video chunk. In 2011, the Moving Image Specialist Group, or MPEG for short, introduced HTTP-based Adaptive Streaming, or DASH [2]. DASH standard is a technique that dynamically determines the appropriate video bitrate on the client side and requests it from the server to increase QoE.

Figure 1 shows how the DASH system works. The basic idea behind design DASH is the fact that the most of the internet users do not have stable bandwidth to download media. To overcome this challenge, the video content is coded in different bitrates and each version is divided into small chunks and stored in the server in chronological order so that the client can choose the appropriate bitrate for each chunk. Different chunks are identified by uniform resource locator (URL) and stored in separate files. The DASH client automatically selects the next chunk to download, taking into account network conditions and bandwidth. Therefore, the client can adapt to changing network conditions and provide video with the least interruption, the highest possible quality, and the least possible change in quality levels [3].

DASH client may employ different methods determine the appropriate bitrate for each video chunk. These methods can be categorized regarding their basic approach into: heuristic methods and learning based methods. heuristic methods are developed by fixed

* Corresponding Author

control rules that make decisions related to bitrate selection that may not be generalizable to different network conditions [4]. In addition to algorithms based on fixed control rules, learning based methods are also available. These algorithms automatically learn how to make bitrate decisions and operate without using any preprogrammed control rules or explicit assumptions about the environment. Learning-based DASH implementations can hire reinforcement learning (RL) techniques to learn a control policy to determine the bitrate, purely through experience [5].

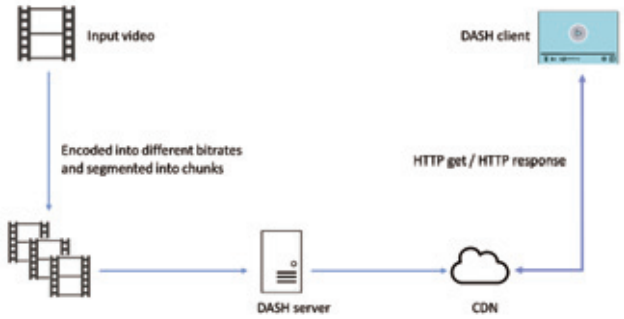

Figure 1: *DASH system architecture*

Learning based DASH implementations facilitate handling video streaming through mitigating the requirement of using a series of fixed control rules. But, in majority of the learning based methods which have been proposed to improve the QoE of DASH based streaming, the effect of video content complexity (VCC) is neglected. This may reduce the user's quality of experience [6].

To face this issue, in this manuscript a modification of the method presented in [7], is proposed in which, video complexity is regarded as one of its inputs. To this end, each chunk would be labeled according to its level of complexity as low, medium and high. After so, the Q-learning algorithm proposed in [7], has been modified in a way that determines the appropriate bit rate for each chunk regarding its complexity label.

To verify effectiveness of the proposed algorithm, it has been tested through several scenarios by conducting different simulations. The results of these simulations have shown that the proposed method is superior in terms of the user's quality of experience compared to the previous methods by reducing the deadline misses. It should be noted that deadline missing caused by empty buffers is the most important factor in reducing the quality of users' experience.

The remainder of this paper is structured as follows. The related work is going to be discussed in Section II. Section III is dedicated to introduce the video content complexity. The proposed algorithm is presented in Section IV and the results of its simulation are provided in Section V. The concluding marks are given in Section VI.

2. RELATED WORKS

DASH-based video streaming methods are generally divided into two categories, which are heuristic methods and reinforcement learning-based methods. Heuristic methods use fixed control rules to select the bitrate of video chunks. These fixed control rules are often based on simple and inaccurate models of the environment, which, as a result, cannot succeed in achieving optimal performance in different conditions of the network [4]. But in reinforcement learning-based methods, decisions related to bitrate selection of each chunk are learned by observing the experience of previous decisions. Therefore, by improving performance at each stage, they automatically learn how to act in different environments.

Because the proposed method presented in this manuscript is a reinforcement learning-based method that uses VCC to improve QoE, in the rest of this section, the main focus is on introducing some MDP-based DASH system using reinforcement learning and examining the strengths and weaknesses of each method. The MDP solution is a policy that tells the system how to make a decision, that is, what action to take when a certain state is observed. The introduction of DASH system based on MDP is given in section IV. In addition to reinforcement learning-based methods, at the end section only one heuristic method is introduced because the initial idea for using VCC was adopted from it.

Bokani et al. proposed an HTTP-based adaptive streaming using MDP [5]. This method uses Q-learning algorithm to obtain its decision policy. Q-learning is a reinforcement learning technique designed by Watkins [7]. It is a technique that provides data based on their values and determines what action an agent should take. Q-learning does not need the explicit state transition model to solve the Markov decision problem [8]. Q-Learning follows a specific policy to perform different actions in different states. This algorithm maintains a table of Q values for all possible pairs (state, action) and gradually updates the table values according to experience. By performing an action, the agent goes from one state to the next state and receives a reward according to the action taken and the next state.

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. 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 deadline missing.

Karimiazar et al. proposed a modified version of the Bokani et al. method to increase QoE by reducing the variation between qualities [9]. In this method, the buffer level in the DASH system is divided into three areas: green (long time until the buffer is empty), yellow (medium time until the buffer is empty), and red (low time until the buffer is empty). In the green area, the system can download high qualities. In the yellow area, the system can download intermediate qualities. In the red area, the system can download low qualities. In this method, three criteria are considered for reward and punishment, which are: deadline misses, average quality of the chunks, and quality changes.

By doing this, the qualities that can be selected in all three buffer conditions will be more limited and the

system actions will be easier; Because there will be more limited decision-making modes. This is the hierarchical reinforcement learning that divides the overall task of the system into several simpler sub-tasks. The Q-Learning algorithm is executed separately in each sub-task. In each sub-task, the system is only allowed to choose the quality corresponding to the buffer level. With this method, the probability of jumping from very high qualities to very low qualities is very low.

Gadaleta et al. proposed D-DASH, a framework that combines deep learning and reinforcement learning techniques to optimize the quality of experience of DASH [10]. The main difference between standard Q-learning is in the way of estimating the Q-value of each state-action pair. standard Q-learning keeps a table of values and updates each state-value pair separately, DQN uses a deep-learning approach to approximate the Q-function. The fast convergence of this method shortens the training phase and makes D-DASH a suitable option for client-side learning. Lin et al. combine the k-nearest neighbor (KNN) with Q-Learning algorithm to propose a KNN-Q learning algorithm [11]. The KNN-Q-learning can learn an optimal policy while the states are continuous. This method can increase the speed of convergence compared to Q-Learning algorithm.

Duan et al. designed a video content complexity-aware DASH bitrate adaptation strategy under the constraints of the network bandwidth and the buffer occupancy [6]. Unlike the presented methods that use learning-based algorithms, this method uses heuristic algorithm. In this method, the complexity of the video content is determined first, and according to the obtained complexity, the buffer level and bandwidth of the bitrate selection system makes appropriate decisions. The main goal in this method is to use low quality to download video parts in low complexity so that it can download high complexity parts with high quality while preserving network resources.

This research has been tried to improve the quality of experience in DASH by using a solution based on reinforcement learning presented in [5]. Also, to obtain the complexity of video chunks, some concepts in [6] have been used.

3. ASSUMPTIONS AND PROBLEM STATEMENT

3-1 ASSUMPTIONS

It is assumed that each chunk of video is encoded at N different quality levels on the server side. Also assumed that the video has K chunks. If k represents the k-th chunk, it can have values from 1 to K. The selected quality for the k-th chunk is denoted by q_k . q_k is selected from the set Q, where $Q = \{Q_1, Q_2, Q_3, Q_4, Q_5\}$ is the set of all selectable qualities. It is also assumed that the duration of all the video chunks is equal to τ seconds. The download time t_k of k-th chunk is equal to the amount of time needed to transfer the chunk with size $S(QL_k)$, and from a channel with bandwidth C_k is equal to $\frac{S(QL_k)}{C_k}$. The level of the buffer at the moment of downloading the k-th chunk is ρ_k. The level of buffer is computed before sending request for the next chunk to server. So, following this, the buffer level upon sending the download request for the $(k+1)$-th chunk is equal to:

$$\rho_{k+1} = \rho_k - t_k + \tau \quad (1)$$

3-2 PROBLEM STATEMENT

In this manuscript, the main goal is to decrease the deadline misses due to increase the quality of the user experience. Deadline misses are the most important factor which affects quality of the user experience. For this purpose, we try to make sure that the client chooses the appropriate quality for each chunk to prevent the deadline misses. The quality selection process of video chunks can be modeled as a Markov decision process (MDP) [11], which is explained in subsection 1 and Subsection 2 describes how to measure the complexity of video chunks.

3.2.1 MDP FORMULATION IN DASH

An MDP problem is determined by the tuple (S, A, P, R, γ). S is the set of all states, A is the set of all possible actions, P is the state transition probability, R is the instant reward and γ is the discount factor of future rewards. In the following, it will be introduced what each of these parameters are in the DASH system implemented on the basis of MDP.

In an MDP-based DASH, system state is determined when a video chunk is completely downloaded. The system state can composed of different parameters. The system reward can also be a function of various parameters, which can be a function of user QoE parameters. In any state, the decision made is called an action. For a DASH system, an action is basically deciding the quality level for the next chunk. To form a MDP solution it is required to specify its action sequence. Taking action sequence called a policy. There are many possible policies but the goal is to find the optimal policy the maximize the expected payoff given immediate rewards and discounted future rewards. On solution for finding optimal policy is reinforcement learning.

In reinforcement learning problem for action selection, the topic of exploration policy is discussed. Depending on the exploration policy, system actions can be specified. One of the important exploration policies in reinforcement learning is the ε-greediness policy [12]. This policy uses previous information with a probability of 1-ε and performs random actions with a probability of ε. One of the weaknesses of this policy is that it does not make any distinction between different actions and considers the probability of choosing any random action to be the same as another. Another policy called Softmax is used to solve this problem [13]. This policy converts the value of reward for each action into a probability function. Therefore, the action that has more reward is more likely to be chosen. In the proposed method Softmax policy has been used. The probability of selecting action a in state s in Softmax policy is given in equation (2). Where $Q(s,a)$ is Q value Obtained by Q-learning algorithm an θ is called temperature.

$$f(s,a) = \frac{e^{\frac{Q(s,a)}{\theta}}}{\sum_J e^{\frac{Q(s,a)}{\theta}}} \quad (2)$$

3.2.2 VIDEO CONTENT COMPLEXITY

The complexity of the video content is a feature of the video that represents the intensity of movement in it. According to the MPEG standard [14], a video is coded in units called group of pictures (GOP). GOP units consist of I, P, and B frames. In each GOP, I frame represents intra-frame compression and P, B frames represent inter-frame compression; This means that P, B frames indicate the movement in the video. Therefore, the ratio r in equation (3) is used to determine VCC [6].

$$r = \frac{R_{P,B}}{R_I} \quad (3)$$

In equation (3), $R_{P,B}$ and R_I are respectively the average number of bits of P and B frames and the average number of bits of I frames in GOP, which are defined in equations (4) and (5).

$$R_{P,B} = \frac{1}{N_P+N_B} \times \left(\sum_{i=1}^{N_P} R_{P,i} + \sum_{i=1}^{N_B} R_{B,i}\right) \quad (4)$$

$$R_I = \frac{1}{N_I} \times \sum_{i=1}^{N_I} R_{I,i} \quad (5)$$

After determining the ratio r for each chunk of video, a VCC is tagged on each chunk. VCC =1 represents low complexity, VCC =2 represents medium complexity and VCC =3 represents high complexity.

MPEG-2 video compression standard is used in this research [15]. Any standard that has a GOP structure can be used to determine VCC. The bit stream structure in this standard is shown in ***Figure 2***. According to the figure, the bit stream has a layered structure. The first layer contains the sequence, the second layer contains the GOP, and the third layer contains images related to each GOP. What is important in determining the complexity is the recognition of images and their type, including I, P, and B. According to the third layer of the bit stream, each image or frame begins with a header, whose content can be used to recognize the start of the frame. At the beginning of the header after the start code, there is a picture start_code_value section with a value of 0x00, which the system detects when the frame starts. In the header of each frame, there is a part called picture_coding_type consisting of 3 bits, which can be used to identify the type of frame. According to the value of these 3 bits in **Table 1**, it is determined whether the frame is of type I, P, or B.

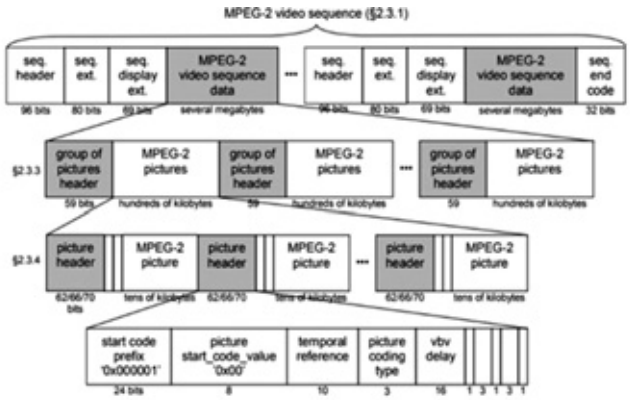

Figure 2: *bit stream structure in MPEG-2 standard [15]*

Table 1: different picture coding types in MPEG-2 [15]

picture coding type	Coding method
001	I
010	P
011	B

To determine the complexity tag, either 1, 2 or 3, the threshold levels L_1 and L_2 are used as shown in ***Figure 3***. If $r \leq L_1$, the complexity level is equal to 1, if $L_1 < r < L_2$, the complexity level is equal to 2, and if $r \geq L_2$, the complexity level is equal to 3.

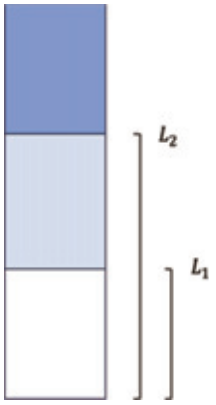

Figure 3: *complexity level thresholds*

After the complexity of each chunk of video is determined on the server side, the MPD (media presentation description) file is used to send this information to the client. A server-side MPD file describes a set of encoded and deliverable qualities of multimedia content.

4. PROPOSED ALGORITHM

According to the goal specified in problem statement and the limitations of the problem in assumptions, it is necessary to use VCC in such a way to achieve this goal. This is used in the proposed method. To design this method, we need to do several things, which are mentioned in the following.

The pseudocode of the proposed algorithm is shown in is shown in the following algorithm.

Q-Learning Algorithm

```
Initialize Q to zero
Download the first chunk using the lowest quality and observe next state
REPEAT
    Update Q
    Calculate Boltzmann probability and use it to select quality q of next chunk
    Download the next chunk using quality q and observ next state
CONTINUE
```

Figure 4: *Q-learning algorithm*

As shown in the ***Figure 4***, the system first downloads the first chunk with the lowest quality, i.e. quality 1, and then observes the system state. After so, the system updates the Q value corresponding to the action performed and the received reward. Then it selects a new action using the Softmax function. After applying the new action,

the new state of the system is also extracted and its Q value is updated again. This procedure continues until all video chunks are finished. In the following, the states and rewards of the system which are based on MDP parameters of the problem, are introduced, and finally, how to update these states with the Q-learning algorithm is mentioned.

The state of the system is determined by buffer level (ρ), quality of the previous chunk (q) and the complexity of the video current chunk (vcc). So, each state is represented as s (ρ, q, vcc).For example, s(14,4,3) represents a state where the buffer level is 14 seconds, the previously downloaded quality is 4, and the current VCC of the chunk that wants to be downloaded is 3. ***Figure 5*** shows an example of changing states by performing different actions and changing complexity in the proposed system. Each house of the table shows a state of the system, where the horizontal axis shows the quality of the last downloaded chunk (q) and the vertical axis shows the buffer level (ρ). For example, the system is first in the state s (0, 1, 2) and then, by choosing quality 1 and changing the complexity to 1, the buffer level of the system is increased to 4 and the system goes to the state s (4, 1, 1). Action selection in any state is taken by Softmax policy.

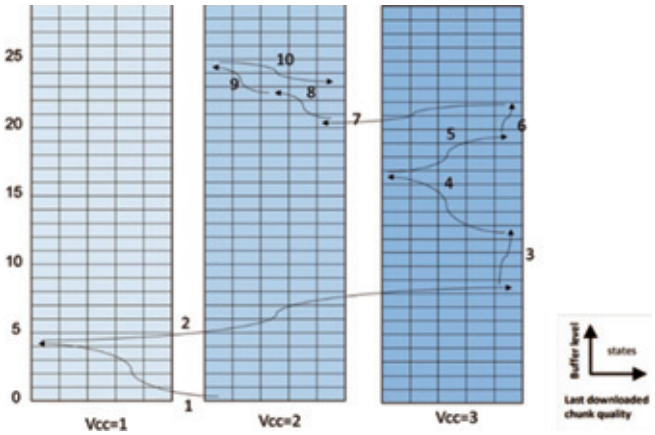

Figure 5: *example of changing states by performing different actions*

The reward function is given in equation (6).

$$R = R_{quality} + R_{switches} + R_{bufferfilling} + R_{vcc} \quad (6)$$

In equation (6) $R_{quality} = f(q)$ is the parameter of the quality level of the requested video chunk, where $f(q)$ is the value of its reward based on the quality selected (q). $R_{switches} = C \times g(q_1,q_2)$ is the parameter of the amount of quality level change, where $g(q_1,q_2)$ is a function to determine the quality change reward and C is a coefficient that determines the importance of this parameter. $R_{bufferfilling} = D$ is the parameter of deadline missing and has fix value D. $R_{vcc} = V \times h(VCC, q)$ is the parameter of VCC, where $h(VCC, q)$ is a function to determine the VCC reward based on the quality selected (q). Coefficient V determines the importance of this parameter.

As mentioned at the beginning of this section, the Q-learning algorithm is used that the agent obtain the optimal policy in the reinforcement learning problem. The goal of the agent is to maximize the total reward. This goal is achieved by learning the best action for each situation. The algorithm has a function that calculates a certain real value as a reward for each combination state and action (s,a). The formula for updating Q is given in equation (7):

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

$$Q_t(s,a) = (1-\alpha)Q_{t-1}(s,a) + \alpha[R(s,a,s') + \gamma max_{a'} Q(s',a')] \quad (7)$$

In equation (9) $R(s,a,s')$ is the reward of going from state s to state s', which is accompanied by action a. α is the learning rate, whose value is (0,1]. This rate determines how much new information is preferred over old information. A value of zero makes the agent not learn anything and a value of one makes the learner only evaluate new information. In fact, the learning rate regulates the updating speed. The discount factor γ determines the importance of future rewards. A value of zero makes the agent consider only current rewards; While the value between zero and one prompts the learner to update the total rewards of the time period according to the foresight created in the relationship Q. If γ is one or more than one, the values of Q diverge.

In the proposed method to reduce the number of deadline misses, when the buffer is in the high-risk area (ρ<10) and the complexity of the video chunk is low (vcc =1), the client chooses low qualities. By doing so the buffer moves out of the high-risk area leading to reduction of deadline misses. This causes the buffer to move out of the high-risk area, which reduces deadline missing.

5. SIMULATION AND RESULTS

At the following the configuration implied who setup the simulation of the proposed algorithm is described, after so the evaluation results of the proposed method are presented and compare with the previous methods. Subsection A covers configuration parameters and subsection B is dedicated to evaluation results.

5-1 SIMULATION PARAMETERS

The benchmark video which is employed in this simulations is Big Buck Bunny video clip, which is also used in the method [16]. The duration of this clip is 9:56 minutes. And it is start in 5 different qualities, encoded by FFmpeg software. The detail of each version of the video are shown in **Table 2**. It worths to note that each version of video is multiplexed with a 128 kbps audio file to create an MPEG-2 video stream. The resulting video content is structured in a bunch of 2-seconds chunks.

Table 2: different qualities

Quality	Bitrate (Kbps)
1	186
2	499
3	1101
4	1292
5	1898

Figure 6 shows the complexity graph for each chunk of video. The value representing the complexity of the video is calculated using method presented in section III. For example, the 55th chunk of the video in the ***Figure 8*** is marked as having a complexity of 2. The average complexity for all chunks of this video is 2.12, which shows that the test video has a medium complexity in general.

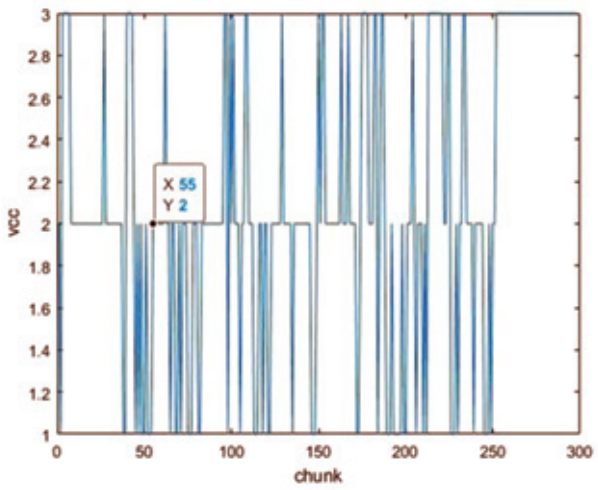

Figure 6: *complexity of Big Buck Bunny video*

In the proposed method, the conditions considered for the learning part are similar to method presented by Bokani et al. [5], so parameters with the same values as method Bokani et al. have been used. The quality reward parameter in equation (8) is according to **Table 3**. $f(q) = f(q) \times 10$ has been used to encourage the system to load high qualities. The deadline miss penalty (D) has a fixed value. In the proposed method, the parameter (D) is set equal to 50. The penalty due to quality change are presented in **Table 4**. The values of other parameters are also given in **Table 5**. The complexity reward parameter is a coefficient of the values presented in **Table 6**. The coefficient of the complexity parameter (V) in the proposed method is equal to 10.

Table 3: quality reward parameter

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

Table 4: penalty due to quality change

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

Table 5: main MDP and VCC parameters

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	$\theta = 0.9$
Maximum level for low complexity	$L_1 = 0.1$
Minimum level for high complexity	$L_2 = 0.3$

Table 6: complexity reward parameter

VCC/q	1	2	3	4	5
1	10	5	0	-5	-10
2	0	0	0	0	0
3	0	0	0	0	0

5.1.1 REWARD FUNCTION PROPERTY

According to the values of each parameter of the reward function of the proposed system in the previous section, it is necessary to have a review on this function in different conditions. In this section, how this function works for different actions is given.

Figures 7 and ***8*** show the three-dimensional and two-dimensional graphs of the reward function for the proposed method, respectively. These graphs are drawn in such a way that the parameters of the reward function caused by quality change and playback stop have a constant value. In this case, the reward function consists of two reward parameters due to complexity and quality. For low complexities, i.e. $VCC = 1$, the lower the quality, the higher the reward (according to **Table 6**), and in medium and high complexities, the system is encouraged to download high-quality chunks (according to **Table 3**).

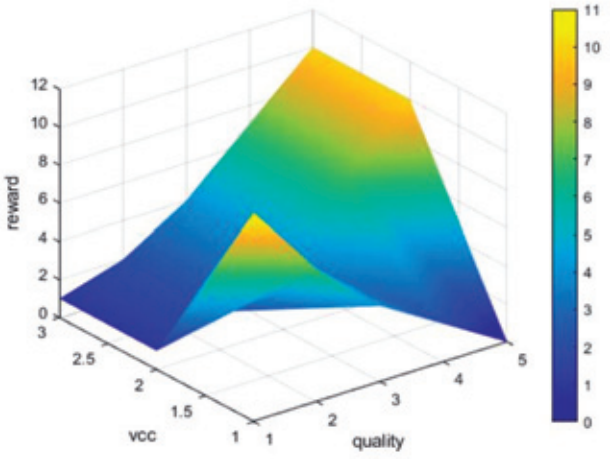

Figure 7: *three-dimensional graph of the reward function*

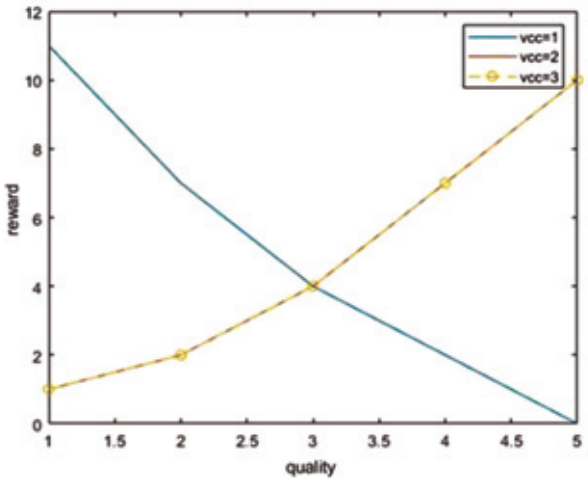

Figure 8: *two-dimensional graph of the reward function*

5-2 SIMULATION RESULTS

Table 7 shows the performance of the proposed method compared to the performance of Bokani et al.'s method [5] and Karimiazar's method [9] for different combinations of quality change penalty (C) and a fixed amount of deadline miss penalty (D). The coefficient of the complexity parameter (V) is also constant and equal to 10. For each combination of D and C, average number of deadline miss (DM) is specified. All these values are obtained from repeated video streaming and averaging the performance of sessions 66 to 71. Table 8 shows the performance

of Bokani et al.'s method [5] and Table 9 shows the performance of Karimiazar's method [9] with similar parameter setting to the proposed method.

Table 7: streaming performance of the proposed method compared to previous methods

C	0.1	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9
Proposed method	4.16	2.66	2.16	1.00	2.16	2.00	3.33	3.66	3.50	2.83
Karimiazar's method	10.24	7.77	10.36	9.89	8.83	8.95	9.66	10.25	4.19	4.28
Bokani et al.'s method	16.71	20.78	27.68	26.34	23.72	23.99	25.83	27.35	26.24	26.25

By comparing the results of the proposed method and the previous methods, it is clear that by regarding complexity in the proposed method, the number of deadline misses decreases. ***Figures 9*** also show the comparison of the number of deadline misses in the proposed method with previous methods. For example, for $C = 0.7$ the average number of deadline misses in the proposed method is 1.00, the average number of deadline misses in the Karimiazar's method is 9.89 and the average number of deadline misses in the Bokani et al.'s method is 26.34.

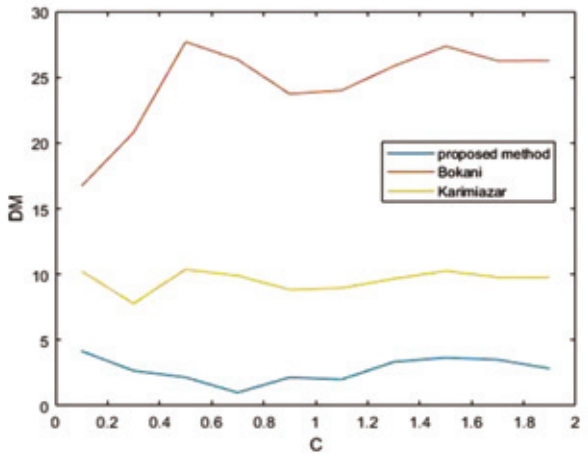

Figure 9: *Comparing the deadline misses in the proposed method with previous methods*

6. CONCLUSION

presented using the complexity of video content. In general, the performance of this system is divided into two general parts. The first part includes determining the complexity of all chunks of the video, and the second part is determining the appropriate bitrate for each chunk using reinforcement learning. The complexity of the video was determined through the video features in the MPEG compression standard. The complexity of the video chunks was divided into three levels low, medium, and high. The criterion of this division is the intensity of movement in the video. The higher the intensity of the movement, the higher the level of complexity.

The second part includes the bitrate determination section using reinforcement learning. Q-learning algorithm is used in this section. The proposed system for allocating rewards and punishments considers four main criteria. These criteria are the complexity of the video, the quality level of the requested chunk, the rate of change of the quality level, and the stop of the playback caused by the emptying of the buffer. The proposed method gradually learns the best strategy for each state through intelligent trial and error. The proposed method has been compared with the method of Bokani et al. and Karimiazar et al. under similar settings and parameters. The simulation results show that this method has been able to decrease the deadline misses compared to previous methods.

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AUTHORS

Dr Mohammad Behdadfar (Responsible Author) was born in Iran in September 1977. He received his B.Sc., M.Sc., and Ph.D. in Electrical Engineering from Isfahan University of Technology (IUT) in 1999, 2002, and 2010, respectively. He is currently a faculty member in the Engineering Department of IRIB University. His research interests lie in high-speed networking, switch/router design, SDN/NFV, audio and video networking, networking algorithms, and QoS (Quality of Service) and QoE (Quality of Experience) in 5G and beyond.

Ali Savadzadeh received his B.Sc. degree in Engineering Science from Tehran University, Tehran, Iran, in 2020, and his M.Sc. in Communications Engineering from IRIB University, Tehran, Iran, in 2024. His research interests include adaptive video streaming, reinforcement learning, and computer networks.

Dr Touraj Shabanian Boroujeni completed his bachelor's, master's, and Ph.D. degrees at Isfahan University of Technology (IUT) in 2001, 2005, and 2013, respectively. Currently, he is a faculty member at the Iran Telecommunication Research Center (ITRC), with research interests that encompass advanced topics in networking, such as Machine Learning (ML), Software-Defined Networking (SDN), Network Function Virtualization (NFV), as well as blockchain and 5G networks.

Dr Amin Ghalami Osgouei received his B.S. degree in Computer Engineering from the Sharif University of Technology, Tehran, Iran, in 2003, and his M.S. degree in Computer Architecture Engineering from the University of Isfahan (UI), Isfahan, Iran, in 2011. He also earned his Ph.D. in Computer Engineering at Isfahan University of Technology (IUT) in 2017. He is currently a faculty member in the Communication Technology Department at the Iran Telecommunication Research Center (ITRC). His main research interests include designing online algorithms, Software-Defined Networking, virtual network embedding, analytical mathematical modeling, blockchain-based systems, and 5G networks. ■

TECHNICAL BUREAU MEETING
18 OCTOBER 2024

The annual ABU Technical Bureau meeting was held on 18th October 2024 in a hybrid format, with some members attending in person and others joining online. The meeting was chaired by the Technical Committee (TC) Chairman, **Mr Masashi Kamei** from NHK-Japan. Approximately nine members attended physically, including representatives from TVB-Hong Kong China, NTV-Nepal, VTV-Vietnam, Prasar Bharati-India, TRT-Türkiye, NBT-Thailand, RTM-Malaysia, NRTA-China and NHK-Japan. Online attendees included representatives from MTV-Sri Lanka, Mediacorp-Singapore, Phoenix TV-Hong Kong China and KBS-Korea.

The session began with a welcome address by ABU Director of Technology, **Dr Veysel Binbay**, who expressed hopes for a productive meeting. The meeting kicked off with updates from various organizations. This information-sharing session allowed members to gain insights into each other's operations and challenges. Members also welcomed the newly elected Topic Area Chairs: **Dr Hirokazu Kamoda** for Distribution and Prakash Veer for Training and Services.

Dr Veysel Binbay, Director of ABU Technology, led and presented the activity report to the bureau members. Key highlights included the completion of the Technical Bureau with 18 members and ongoing initiatives to increase distribution and attract more advertising to support the Technical Review (TR) magazine, published quarterly. He also discussed plans to incorporate a dedicated session for TB members in the upcoming DBS program. Furthermore, an internal initiative aimed at standardizing workflows across departments was highlighted. The 3-Year Action Plan was introduced and will be circulated among members for feedback. The appointment of two rapporteurs for the Technical Committee, **Mr Shafiq Mirza** (RTM-Malaysia) and **Ms Gül Tuğba Yildiz** (TRT-Türkiye), was also announced and approved by the members. Finally, Dr Binbay presented a recommendation on the World Radiocommunication Conference (WRC), emphasizing the need to protect and preserve the spectrum for broadcasters.

The meeting progressed with discussions on frequency band allocations for satellite services. Specific attention was given to agenda items 1.4 and 1.9, focusing on new primary allocations and the use of the 7 to 8 GHz band for broadcasting purposes. The importance of protecting fixed services in this band was emphasized, with plans to monitor potential developments.

Attention then turned to the upcoming Technical Committee meeting, covering agenda details, keynote speakers, and a panel session on AI in broadcasting. Changes in topic area chairmen and project management roles were also addressed by Dr Veysel.

The 21st edition of the DBS was highlighted, with a focus on attracting more participants and enhancing the event experience. The next meeting will be held at Wyndham Acmar Hotel in Klang, just outside Kuala Lumpur, marking a shift from previous venues. Dr Veysel expressed optimism that this change would add value for participants and called for sponsorships, inviting all TB members to support the event. Due to Ramadan beginning in early March, the event has been rescheduled for February.

The next Technical Bureau meeting is tentatively scheduled for 12th to 14th June 2025 in Ho Chi Minh City, Vietnam, subject to further discussion from VOV-Vietnam. During the final agenda item, Chairman **Mr Masashi Kamei** invited members to raise any additional. The importance of regular knowledge sharing was emphasized, with **Mr Bishnu Ram Neupane** (NTV-Nepal) suggesting the implementation of daily or monthly report sharing. Vice-Chairman **Mr Kazim Pektas** proposed the creation of an innovation hub to foster collaboration within ABU. This initiative will be further discussed and refined among the members and ABU Secretariat, with Mr Pektas expressing hope that the new workflow can be finalized at next year's Mid-Year Technical Bureau Meeting.

The meeting concluded with closing remarks from Mr Kamei, who thanked the hosts and participants for their active engagement. He expressed anticipation for the upcoming TC meeting in Connie II Hall and next year's mid-year Technical Bureau meeting. ■

TECHNICAL COMMITTEE MEETING

19-20 OCTOBER 2024

The ABU Technical Committee Meeting was held on 19 October 2024, hosted by the ABU full-member Turkish Radio and Television Corporation (TRT) at the Hilton Ballroom & Conference Center in Harbiye, İstanbul. The event commenced with a welcoming address by **Mr Masashi Kamei**, Chairman of the ABU Technical Committee and Senior Research Engineer at NHK.

OPENING SESSION

As part of the 61st ABU General Assembly, the ABU Technical Committee 2024 Meeting commenced with opening remarks by Committee Chairperson **Masashi Kamei**. He emphasized the pivotal role of technological innovations, particularly artificial intelligence (AI), in shaping the future of broadcasting. This was followed by a warm welcome from **Mahmut Hilmi Önger**, Head of the Archive Department at TRT-Türkiye, who reflected on the industry's ongoing transformation and celebrated TRT's 60th anniversary. ABU Secretary-General **Ahmed Nadeem** also addressed the gathering, expressing his gratitude to the host organization and highlighting the committee's critical role in fostering discussions on emerging technologies and broadcasting innovations.

ABU TECHNICAL AWARDS 2024

The meeting began with the announcement of the winners of the 2024 Annual ABU Engineering Awards and Technical Review Prizes. These prestigious awards recognized individuals and organizations for their exceptional contributions to the advancement of broadcasting engineering and innovation across various categories. Prizes were awarded for the best papers published in the ABU Technical Review journal, highlighting excellence in three key areas: Practical Implementation, Research, and Case Studies. In addition, winners were honoured in five distinguished categories: Broadcast Engineering Excellence, Engineering Industry Excellence, SDGs Implementation, Developing Broadcasters' Excellence, and Young Engineers' Broadcasting. Each recipient received a certificate and trophy to commemorate their achievements.

This year, the ABU received a record number of nominations for the Engineering Awards, totalling 21. This reflects how much members value such recognition and encourages future innovative projects among member staff. The Engineering Awards consist of five categories:

- ABU Broadcast Engineering Excellence Award
- ABU Engineering Industry Excellence Award
- ABU Broadcast Engineering Award on SDGs Implementation
- ABU Developing Broadcasters' Excellence Award
- ABU Young Engineers' Broadcasting Award

ABU Broadcast Engineering Excellence Award

ABU Engineering Industry Excellence Award

ABU Broadcast Engineering Award on SDGs Implementation - CBNET, China

ABU Broadcast Engineering Award on SDGs Implementation - RTM, Malaysia

ABU Developing Broadcasters' Excellence Award

ABU Young Engineers' Broadcasting Award

Technical Review Magazine Best Article in Practical Implementation - RTM, Malaysia

The ABU Broadcast Engineering Excellence Award was the first to be announced, recognizing Dr Peyman Jebelli from IRIB-Iran. A representative from IRIB-Iran accepted the award on his behalf, which was presented by Mr Mahmut Hilmi Önger, the host from TRT-Türkiye.

Next was the ABU Engineering Industry Excellence Award, awarded to Mr Gu Jianguo from RTPRC (NRTA)-China. His representative accepted the honor, presented by Kazim Pektas, the ABU Technical Committee Vice Chairman.

The ABU Broadcast Engineering Award on SDGs Implementation acknowledged exceptional contributions toward sustainable development goals. This category had two joint winners:

- CBN-China was recognized for the "CBN National Internet Backbone Network (CBNET) (Phase I)" project, which promotes cost efficiency, accelerates industry upgrades, and supports sustainable development. The award was presented by Masashi Kamei, Chairman of the ABU Technical Committee.
- RTM-Malaysia received the award for enhancing RTMKlik's cloud infrastructure, ensuring sustainability, reliability, accessibility, and fostering inclusive industrialization. This award was also presented by TRT Host Mahmut Hilmi Önger.

The ABU Developing Broadcasters' Excellence Award celebrated Mr Nilupa Ranaweera from EBC-Sri Lanka for his visionary ideas and innovative broadcast solutions, which enabled seamless platform integration and expanded content reach. Lastly, the ABU Young Engineers' Broadcasting Award honored Dr Cheng Haonan from RTPRC (NRTA)-China for his outstanding contributions to broadcast technology, presented by Masashi Kamei, Chairman of the ABU Technical Committee.

The ceremony continued with the announcement of the Technical Review Prizes, which honour outstanding contributions to broadcast engineering through articles published in the Technical Review magazine between October 2023 and September 2024. The awards were presented across three categories:

Best Article in Practical Implementation: Awarded to Ir. Ts. Ahmad Shafiq Mirza bin Mansor, Ts. Tarmimi bin Sahad, and Engr. Mazlina binti Mohd Yusoff from RTM-Malaysia for their insightful article, "Proof of Concept (PoC) Public 5G Network Slicing Technology for Radio Televisyen Malaysia (RTM) Broadcast Facilities and Services: Part 1 – Readiness of the Trial Execution."

Best Article in Research: Presented to Amir Reza Saadatmand Tale and Dr. Mohieddin Moradi from IRIB-Iran for their ground-breaking research article, "Contrast Enhancement of Low-Light Images Based on Dynamic Range Changes."

Best Article in Case Studies: Recognized Maryam Sedaghat from IRIB-Iran for her compelling case study, "DVB-Native IP: Filling the Gap Between Broadcast and Broadband Networks."

These awards highlight the authors' innovative ideas, thorough research, and practical contributions to advancing the field of broadcast engineering. The ceremony concluded with TC Chairman Masashi Kamei congratulating all the winners.

KEYNOTE PRESENTATION

The first day of the meeting unfolded with a series of engaging presentations and thought-provoking discussions, commencing with a captivating keynote address delivered by **Mr Micheal McEwen**, a prominent media consultant and advisor to the Advanced Television Systems Committee (ATSC). McEwen took the audience on a journey through the remarkable evolution of broadcast technology, illustrating how it has continuously reshaped the media landscape and influenced industry dynamics.

In his address, he placed significant emphasis on the critical need for collaboration among broadcasters, industry associations, and esteemed global organizations such as the International Telecommunication Union (ITU). He asserted that only through united efforts could these stakeholders effectively tackle pressing global challenges and harness the benefits of rapidly advancing technologies.

Drawing from his rich experience in the field, McEwen shed light on innovative technologies that have transformed broadcasting, including electronic news gathering (ENG) and the development of digital pipelines. He articulated the necessity for strategic decision-making and achieving market consensus to thrive in this ever-evolving environment.

Moreover, he addressed the industry's gradual pivot toward IP-based services, outlining the various challenges that streaming platforms present to traditional broadcasting models. With a sense of urgency, McEwen concluded his speech by emphasizing the vital importance of embracing change and nurturing collaborative relationships. He urged attendees to equip themselves for the future, where adaptability and innovation will be essential for navigating ongoing technological advancements and industry transformations.

TECHNICAL COMMITTEE PROCEEDING

The Technical Committee Proceedings began with the confirmation of the agenda for TC2024 and the proceedings for TC-2024. Ts. Ahmad Shafiq Mirza Bin Mansor from RTM-Malaysia and Gül Tuğba Yildiz from TRT-Türkiye were appointed as rapporteurs for the two-day session.

Dr Veysel Binbay, the Director of ABU Technology, summarized the Technology Activity Report, highlighting several key initiatives. The group organized various workshops and masterclasses, provided advisory services, and managed 19 study projects across four topic areas. They published quarterly reports and technical articles, emphasizing contributions from members. International collaborations with unions were noted, along with a successful webinar held on September 23, which attracted 90 participants. Other significant events included a workshop in China with 60 attendees and a joint webinar that drew over 200 participants from 70 countries. The report concluded with a call for participation in upcoming events and publications.

The discussion then shifted to the importance of the upcoming World Radiocommunication Conference 2027 (WRC-27) for broadcasters in the Asia-Pacific region. There was a strong emphasis on the need to protect and secure allocated spectrum frequencies from potential encroachment by other wireless communications. The WRC, held every four to five years (with the last one taking place in Dubai), addresses critical spectrum issues that affect broadcasters. Chairperson Masashi Kamei recommended a thorough review of these items to ensure that broadcasters have access to the necessary spectrum to support the evolving needs of the industry.

A key recommendation was made to review WRC-27 agenda items relevant to broadcasters in the Asia-Pacific region, with the aim of securing necessary spectrum access to meet the growing demands of broadcasting services. The Director of ABU Technology also presented a proposal on key recommendations for WRC-27, which had been initially approved

at the Technical Bureau meeting and was up for final approval by ABU members in attendance.

INVITED PRESENTATIONS | ADVANCEMENTS IN BROADCASTING TECHNOLOGY & STANDARDS (PART 1)

The day continued with presentations by invited speakers, including **Lindsay Cornell**, Chairman of WorldDAB Technical, who provided an update on DAB+. **Alexander Zink**, Vice Chairman of the DRM Consortium, who discussed the latest on DRM technology; and **Matthew Phillip**, Product Director for Broadcast and Maritime at CML Micro, who shared insights into global DRM usage. **Mei Jianping**, Director of the Data Application Department at China Media Group (CMG), presented advancements in 5G-based UHDTV/HDTV contribution. The session was moderated by **Bishnu Ram Neupane**, Deputy General Manager,

NTV, Nepal and also a member of the ABU Technical Committee.

A global update on DAB and new projects, including the eMERGE system was introduced by **Lindsay Cornell** in his presentation. It emphasized the core benefits of broadcast radio, such as bringing news, local culture, and being reliable in emergencies. However, the challenges faced by radio due to full spectrum were highlighted, and the opportunity provided by digital radio was discussed. DAB+ was introduced as a technology that brings together various services in the same transmission, enhancing diversity and content.

The features of digital radio and its market penetration were explained, with the UK as an example where DAB represents two-thirds of all listening. The recent digital radio plans in Indonesia and the interest in digital radio in Africa and the Middle East were also mentioned. Finally, an update was provided on the Emergency Warning System (EWS), including its design and standards.

Alexander Zink in his presentation stated that DRM has emerged as a significant digital radio solution across the Asia-Pacific region, with notable implementations and developments in 2024. As a global, open digital radio standard endorsed by ITU, DRM supports all frequency bands and serves as a direct digital successor to traditional AM/FM broadcasting.

The technology has gained particular traction in major Asian markets, with India potentially covering 900 million people through 41 transmitters, and China endorsing DRM for domestic AM band transmissions. Indonesia has officially published its Digital Radio Policy, while Pakistan has adopted DRM as its standard for all frequency bands. The system offers innovative features such as Multichannel-DRM, allowing multiple broadcasters to share a single transmitter infrastructure, and advanced Emergency Warning Functionality (EWF) for disaster alerts.

Matthew Phillips provided an update highlighting the significant progress of DRM integration in vehicles, with over 6 million car receivers now on Indian roads. The technology's success is further demonstrated by ongoing trials and demonstrations in several countries, including Nepal, Malaysia, Thailand, and New Zealand, underscoring DRM's potential as a comprehensive digital radio solution for the region.

Next, **Mei Jianping** shared a remarkable evolution in media

transmission capabilities made by China Media Group (CMG) in pioneering the integration of 5G technology in broadcasting since 2018. Through their 5G-based Media Application Laboratory, they've achieved significant breakthroughs in portable encoding and decoding transmission technology. From the 70th anniversary of China's National Day to the 2023 Hangzhou Asian Games, CMG has continuously refined their system, dramatically reducing encoding latency from 1.5 seconds to just 0.2 seconds while making the equipment more compact and efficient.

The technology has proven particularly valuable in diverse scenarios, from multi-view live sports coverage to high-speed railway broadcasts during the 2022 Beijing Winter Olympics. Their system supports everything from ultra-low latency transmission to lightweight AR virtual production, enabling frame-level synchronized multi-channel production. Looking ahead, CMG is actively involved in setting new ITU standards and plans to expand their capabilities through millimetre wave technology and enhanced cloud integration, demonstrating their commitment to advancing broadcast technology in the 5G era.

THE HOST PRESENTS | TRT - TÜRKIYE

The session continued with presentations by the host representatives from TRT, Türkiye: **Dr Ruhi Taş**, Deputy Director of Information Technologies, and Soud Hyder, Deputy Director of Strategy & Audience. The meeting focused on the integration of AI in various business and media applications. Key points included the development of AI-powered products like an AI-driven Western answering application, video subtitling, and content summarization tools. The discussion highlighted the importance of AI in solving repetitive tasks, improving content creation, and enhancing operational efficiency. The panel emphasized the need for human oversight to maintain editorial integrity and ethical standards. They also discussed the challenges of scaling AI applications globally and the potential of AI in generating realistic media content. The session concluded with a Q&A on AI customization and integration into existing systems.

The presentations by Dr Ruhi Tas were conducted in Local Turkish Language and provided an overview of the various AI-based products that have been developed by the IT department over the past two years. These include an AI-powered Western answering application, which allows users to interact with the AI and receive answers to their questions, as well as a video subtitling application that utilizes AI technology to provide real-time subtitles.

In addition to these core applications, the team has also created several other AI-powered tools, such as a voice cast feature for automatically generating podcast productions, an AI-powered headline and summary generator, and an AI archive application. While these applications are currently operational, the team acknowledged that they are still working to improve their efficiency and add additional capabilities.

A notable aspect of the AI-based solutions presented was their language translation capabilities. It was highlighted that the applications support 41 source languages and can convert content to 51 target languages, enabling widespread accessibility and usage. To encourage audience engagement, participants were invited to try out the applications through the TRT and TI mobile apps, where they could interact with the AI in their preferred language and provide feedback.

Mr Soud Hyder, delivered an impressive presentation alongside his co-presenter, Enes Beşinci on the use of AI in content management and editorial workflows. It was explained how AI is leveraged to generate metadata, titles, and descriptions for media assets, significantly reducing the time and effort required from editors. This AI-powered approach to content management was noted as a crucial step in scaling content production and translation across multiple languages.

However, the importance of maintaining editorial integrity and cultural nuances when utilizing AI was also emphasized. They described their approach to providing AI-powered editorial guidance and translation, ensuring quality and consistency in the final output.

The presentation also touched on the strategic integration of AI within content management and editorial processes, as well as the broader economic discussions surrounding Türkiye's engagement with the Arab world.

Mr Soud Hyder's presentation concluded Day 1 and the meeting was adjourned. Day 2 was set to resume the next morning.

TOPIC AREA REPORTS

On Day 2 of the meeting, before the Topic Area Reports session began, Mr Kamei emphasized the establishment of new chairs and invited Dr Veysel to provide additional details. Dr Veysel explained that two new topic area chairpersons had been appointed during the previous Technical Bureau Meeting.

The newly appointed chairperson for the Distribution Topic Area is **Dr Hirokazu Kamoda** from NHK-Japan, who has garnered significant attention for his impressive work on 4K and 8K transmission systems. In the Spectrum Topic Area, **Dr Li Leilei** from NRTA-China will lead efforts related to the World Radiocommunication Conferences (WRC). Finally, **Mr Prakash Veer** from Prasar Bharati-India has been appointed to lead the Training & Services Topic Area, bringing extensive experience and considerable contributions in the fields of policy and production.
The meeting continued with the presentations of the Topic Area Reports, beginning with the Production Topic Area, presented by its Chairman, **Mr Kazim Pektas** (TRT-Türkiye).

PRODUCTION

Mr Kazim Pektas highlighted that there are four project groups under this topic area and emphasized key points regarding their work.

1. UHD TV and Advanced Immersive Sensory Media Systems:
   This project group monitors developments in UHD TV, studies technical specifications, and explores the use of AR, VR, and 3D video in advanced immersive sensory media systems. Additionally, it plans to facilitate the exchange of program technology within the ABU region.

2. Systems for People with Special Needs:
   This group focuses on broadcasting services tailored to individuals with special needs.

3. IT-Based Production Systems and File-Based Workflow:
   This group studies IP-based program production, aiming to gather operational know-how and improve production workflows.

4. Big Data, Personalization, and Artificial Intelligence:
   Kazim Pektas also discussed use cases for Big Data, including data analysis for personalization, leveraging this data for broadcasters, and deploying AI technologies. He also acknowledged a significant contribution to this topic area by Mr Kimihiro Tomiyama (NHK-Japan), which comprised two elements:
   - Volumetric data acquisition using Meta Studio.
   - Volumetric video production support systems.

   He briefly explained volumetric video, volumetric capture, and the concept of six degrees of freedom, providing insights into NHK's contributions.

Kazim Pektas then transitioned to his presentation topic: AI Terminology, underscoring the importance of understanding AI as a tool rather than a toy, given its increasing prevalence across industries. His

presentation included slides on:

1. Large Language Models (LLMs): Foundation models trained on vast amounts of data.

2. Transformers: Deep learning models, including encoder-decoder architecture.

3. Vision Transformers (ViTs): Models tailored for visual tasks.

He clarified that deploying AI models does not require extensive computational work, but training these models demands significant computational resources. He concluded by summarizing:

1. Multimodal AI: AI models integrating multiple data modalities.

2. Vision Language Models: Their components and applications.

3. Generative AI: Its types and uses, emphasizing its transformative potential for broadcasters.

DISTRIBUTION

Next guest on floor was Distribution Topic Area Chairman **Dr Hirokazu Kamoda**. Dr Kamoda expressed that there are 3 project groups under this topic area which are Next Generation Terrestrial Broadcasting (D/NGBT), Integrated Broadcast-Broadband and OTT (D/IBBOTT) and Satellite Broadcasting (D/SB).

Next Generation Terrestrial Broadcasting report includes following topics:

1. Efforts towards the realisation of next generation terrestrial broadcasting in Japan: Dr Kamoda gave detailed information about some key notes of this research topic.

2. Development of ATSC 3.0 & 5G-Broadband transmission technique in the republic of Korea: Dr Kamoda told that there was a field test comparing ATSC3.0 & 5G Broadband about which one have higher reception than the other, which one has better field strength and deployments of ATSC 3.0 in different part of the World.

3. Other topics on TV 3.0 and 5G broadcast.

Dr Kamoda continued that Integrated Broadcast-Broadband and OTT topic are report consisted of 4 parts, which were Standardisation of Integrated Broadcast-Broadband System in Japan, studies in ITU-R, studies in ITU-T and Cybersecurity. He also mentioned ongoing developments in Japan. NHK has proposed the Content Discovery System which is web-based system architecture. And EBU cybersecurity recommendations was updated.

Latest topics on Satellite Broadcasting and ITU-R documents related to satellite broadcasting systems was discussed on Satellite Broadcasting topic area projects group report.

SPECTRUM

Next presenter was Spectrum Topic Area Chariman **Dr Li Leilei** (NRTA-China). He mentioned World Radiocommunication Conferences (WRC), which was held every 3 or 4 years to review and revise the Radio Regulations on how to manage the spectrum based on agenda items determined by the ITU Council. There will be WRC-27 conference in 2027 in the light of the conference held in 2023. He specifically stated that so that some WRC-27 agenda items may affect the broadcasting system in Asia Pacific region. Ensuring that the broadcasting community's interests are well-represented in the related ITU meetings was crucial.

Active member participation, collaboration, and advocacy are essential for the sustainable operation of broadcasting systems. And he suggested that ABU members should evaluate whether WRC-27 agenda items could impact their broadcasting system. Confirm and share findings from the spectrum Topic Area report to ensure a coordinated and informed decision-making process. Engage with national and regional regulatory bodies to effectively represent the interests of broadcasters. Consider the long-term implications of spectrum allocations and advocate for sufficient spectrum availability to meet future broadcasting needs. He gave key points of WRC-27 agenda items 1.4, 1.9, 1.13, 1.17, 1.6, 1.10 and enlightened us what precautions should be taken.

TRAINING & SERVICES

Dr Li Leilei gave floor to **Mr Prakash Veer** (Prasar Bharati- India) the chairman of Training & Services Topic Area. Mr Veer drew attention that broadcasting is fast changing. Rapid changes in technology also change broadcasting. And broadcasting should be updated with the technologies mentioned so far. We should be updated in AR, VR, Live, Sports, interactive, digital fields as well. Furthermore, OTT challenges the traditional broadcasting methods.

There is a great expansion in the field of Broadcasting. Expanding in broadcasting sector is not only affects people working in technical fields but also content creators. This effect could be minimized by determining technical training priorities and members requirements which may include conducting surveys, identifying of technical needs, collaborating and connecting activities with ABU Media, technical skill building then knowledge sharing.

INVITED PRESENTATIONS | ADVANCEMENTS IN BROADCASTING TECHNOLOGY & STANDARDS (PART 2)

In the afternoon session, Kazim Pektas moderated the "Advancements in Broadcasting Technology & Standards" session. His first speaker was **Dr Peter Siebert** (Adcom Member & VP, IEEE Broadcast

Technology Society). Dr Peter provided an overview of IEEE Broadcast Technology Society (BTS) and its mission to serve the needs of the broadcast technology industry. BTS is an international membership organization aimed at enhancing professional knowledge by keeping members informed about the latest research and industry trends. He then walked the audience through the history of Digital Video Broadcasting (DVB) standards, starting from a secret meeting in 1991. He highlighted the evolution of DVB from its first-generation specifications, focusing on MPEG2 audio, to its second-generation standards. He posed the question, "What do audiences want?" and emphasized that audiences seek content anytime, anywhere, leading to the rise of IP-based delivery. Dr Peter quoted BBC Director-General Tim Davie's vision of an "internet-only" future, where broadcast TV and radio are switched off, and content choice becomes infinite. He concluded by reaffirming that DVB still plays an essential role in the TV ecosystem and will continue to do so in the future.

Next, Kazim Pektas invited **Dr Mohieddin Moradi** (IRIB-Iran) to present his paper titled "A Novel Approach for Broadcasting 208 Local TV Channels for the Parliamentary Election". Dr Moradi explained that Iran has 31 provinces, and IRIB, the sole broadcaster using the digital terrestrial TV (DTT) system, provides localized content through provincial TV channels. He shared the challenge of insufficient capacity for these channels and described how they overcame this issue during the election period by creating local TV channels with regional coverage. The goal was to broadcast promotional content for candidates within the geographical boundaries of each constituency. The solution involved using multi-channel playout servers, cloud storage, and the IRIB mux2 to optimize the DTT platform without imposing additional costs on broadcasters or the audience.

Masashi Kamei presented on "Progress and R&D of Transmission Technologies for Satellite Broadcasting in Japan". He discussed the advancements in 12-GHz-band satellite broadcasting, specifically the development of ISDB-S3, which made it possible to broadcast 8K UHDTV in a single transponder channel. He also mentioned the development of satellite transmission systems for the 21-GHz-band, highlighting the performance of the BSAT-4a satellite launched in 2017. Mr Kamei emphasized the ongoing R&D efforts focused on high-capacity transmission and efficient rain attenuation compensation.

The final speaker of the session was **Mr Michael McEwen** (Media Consultant, Advisor to the ATSC), who provided valuable insights into ATSC (The Broadcast Standards Association) and the updates surrounding ATSC 3.0. Founded in 1983, ATSC's mission is to advance terrestrial digital broadcasting and facilitate interoperability with other media. Mr Michael highlighted the advancements in ATSC 3.0, including its hybrid OTA/OTT system architecture, additional capacity, and better reception. He noted that 75% of broadcasters worldwide are currently broadcasting with ATSC 3.0. He also discussed the deployment of ATSC 3.0 in various countries and the ongoing projects aimed at harmonizing ATSC with Third Generation Partnership Project (3GPP) standards for cooperation between broadcast core networks and 5G core systems.

MEMBERS' UPDATES AND CLOSING

The meeting proceeded to the final agenda item: Information and Status Report Update. The ABU Secretariat from the Technology Department provided a concise summary of the members' status reports, which have been compiled and made available on the ABU website.

The session continued with a presentation by **Leroy Zang** (CCBN – China Content Broadcasting Network), who highlighted China's significant initiatives and projects related to UHD. He emphasized that CCBN, as the largest broadcasting technology and equipment expo in the Asia-Pacific region, combines exhibitions with technical and business conferences. Notably, the Keynote Speech Conference and the CCBN-Broadcasting Development Forum (CCBN-BDF) offer a platform for industry leaders to explore the latest trends and showcase cutting-edge broadcast technologies. He concluded by inviting attendees to the 2025 CCBN event, scheduled to take place in Beijing from 22-25 April.

Lastly, Dr Veysel announced that the Digital Broadcasting Symposium (DBS) 2025 will be held in Kuala Lumpur from 24-27 February, and the 62nd ABU General Assembly in 2025 will take place in Mongolia, hosted by MNB (Mongolian National Public Television). On behalf of the ABU Technical Committee and its members, he extended best wishes to MNB for the success of next year's General Assembly.

CLOSING REMARK

At the conclusion of the 2024 Technical Committee meeting, the TC Chairperson, Masashi Kamei, expressed his heartfelt gratitude to TRT for their exceptional hospitality in hosting the event. He also thanked the ABU for their excellent organization, noting that the meeting was highly successful, offering invaluable insights and input. He highlighted that the discussions throughout the meeting were both engaging and beneficial for all ABU members.

On behalf of the Technical Committee, Mr Kamei extended his thanks to all the speakers for their contributions and support to the ABU. He also congratulated the winners of the Technical Review Prizes and the ABU Engineering Awards in various categories.

CONTRIBUTED BY RAPPORTEURS

Ts. Ahmad Shafiq Mirza Bin Mansor, RTM, Malaysia
Gül Tuğba Yildiz, TRT, Türkiye ■

REPORT OF TOPIC CHAIRMAN

TOPIC AREA: SPECTRUM

Chairperson: **Dr Li Leilei (NRTA)**
Period of Report: **November 2023 to September 2024**
Date of Report : **September 2024**

Introduction about scope of the work:
This report is on the Topic Area Spectrum Issues which including the related WRC-27 Agenda items concerning broadcasting service and ABU spectrum issues.

Project Topic 1: **To consider a possible new primary allocation to the fixed-satellite service (space-toEarth) in the frequency band 17.3-17.7 GHz and a possible new primary allocation to the broadcasting-satellite service (space-to-Earth) in the frequency band 17.3-17.8 GHz in Region 3, while ensuring the protection of existing primary allocations in the same and adjacent frequency bands, and to consider equivalent power flux-density limits to be applied in Regions 1 and 3 to nongeostationary-satellite systems in the fixed-satellite service (space-to-Earth) in the frequency band 17.3-17.7 GHz, in accordance with Resolution 726 (WRC-23); (WRC-27 AI 1.4)**

Project Manager:
Co- Project Manager: **Mr Rajeev Kumar**
Time Period: **November 2023 to September 2024**

The following tasks were considered for this project:
1. Follow developments of studies in WP 4A to identify and possible impact on Broadcasting Services.
2. Possible impact on broadcasting service in Asia-Pacific Area.

This report was provided by Dr Li Leilei

BACKGROUND

Working Party 4A has been identified as a "Responsible group" for WRC-27 agenda item 1.4. The first meeting has already been held. The meeting drafted the working plan, the main elements of the agenda item working document, the main elements of the agenda item CPM draft working document and the liaison statement. The tasks of Working Party 4A are shown as follows:

1. Studies on sharing and compatibility between the FSS (space-to-Earth), the BSS (space-to-Earth) and the FSS (Earth-to-space) designated by No. 5.516 in order to consider a possible new primary allocation to the FSS (space-to-Earth) in the frequency band 17.3-17.7 GHz for Region 3 and to the BSS (space-to-Earth) in the frequency band 17.3-17.8 GHz for Region 3, while ensuring the protection of existing primary allocations in the same and adjacent frequency bands, and without adversely affecting the existing allocations to the FSS (Earth-to-space) designated by No. 5.516, including assignments to the BSS feeder links contained in Appendix 30A.
2. Consideration of the applicability of Region 2 non-GSO FSS epfd limits (see noting e)) pertaining to the frequency band 17.3-17.7 GHz to Regions 1 and 3, so as to ensure the protection of GSO networks.

PRELIMINARY VIEWS

If this agenda item can promote the new satellite broadcasting service in the 17.3-17.8 GHz band, it will greatly benefit the live satellite service in the Asia-Pacific region. The new spectrum will lay the foundation for business development and also facilitate more flexible transponders for subsequent live satellite systems. Therefore, it is necessary to pay attention to the positions and viewpoints of relevant countries in the world, carry out relevant compatibility analysis in a timely manner, and study the strategies and positions of participating in corresponding international conferences.

Project Topic 2: **to consider technical and regulatory measures for fixed-satellite service satellite networks/systems in the frequency bands 37.5-42.5 GHz (space-to-Earth), 42.5-43.5 GHz (Earth-to-space), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space) for equitable access to these frequency bands, in accordance with Resolution 131 (WRC-23) (WRC-27 AI 1.6)**

Project Manager:
Co- Project Manager: **Mr Rajeev Kumar**
Time Period: **November 2023 to September 2024**

The following tasks were considered for this project:
1. Follow developments of studies in WP 4A to identify and possible impact on Broadcasting Services.
2. Possible impact on broadcasting service in Asia-Pacific Area.

This report was provided by Dr Li Leilei

BACKGROUND

Working Party 4A has been identified as a "Responsible group" for WRC-27 agenda item 1.6. The first meeting has already been held. No technical study is planned under this agenda item, as no output document has been produced.The task of Working Party 4A is to study the technical and regulatory measures for FSS satellite networks/systems in the frequency bands 37.5-42.5 GHz (space-to-Earth), 42.5-43.5 GHz (Earth-to-space), 47.2-50.2 GHz (Earth-to-space) and 50.4-51.4 GHz (Earth-to-space), or portions thereof, for equitable access, while ensuring the protection of existing primary services to which the band is allocated in the same and adjacent bands, taking into account the specific needs of developing countries:

- without adversely affecting those services, specifically the operation of the satellite networks and systems in the bands.
- without changing measures to protect terrestrial services from unacceptable interference.

PRELIMINARY VIEWS

This agenda item involves the allocations of satellite broadcasting service and terrestrial broadcasting service in the 40.5-42.5GHz band, so it is necessary to pay attention to the positions and views of relevant countries in the international community.

Project Topic 3: **to consider appropriate regulatory actions to update Appendix 26 to the Radio Regulations in support of aeronautical mobile (OR) high frequency modernization, in accordance with Resolution 411 (WRC-23)(WRC-27 AI 1.9)**

Project Manager:
Co- Project Manager: **Mr Rajeev Kumar**
Time Period: **November 2023 to September 2024**

The following tasks were considered for this project:
1. Follow developments of studies in WP 5B to identify and possible impact on Broadcasting Services.
2. Possible impact on broadcasting service in Asia-Pacific Area.

This report was provided by Dr Li Leilei

BACKGROUND

Working Party 5B has been identified as a "Responsible group" for WRC-27 agenda item 1.9. The first meeting has already been held. The meeting drafted the working plan and liaison statement. The tasks of Working Party 5B are shown as follows:

1. Studies on the introduction of new technologies that enhance performance, including, but not limited to, new classes of emission, wideband systems (see recognizing c), d) and e)), etc., to the aeronautical mobile (OR) service systems in the frequency ranges considered in Appendix 26.
2. In order to undertake resolves to invite ITU Radiocommunication Sector to complete in time for the 2027 world radiocommunication conference 1, the definition of the relevant technical and operational characteristics and conduct sharing and compatibility studies with existing aeronautical mobile (OR) service systems and with other incumbent services that are allocated on a primary basis in the same or adjacent frequency bands.
3. Based on ITU Radiocommunication Sector (ITU-R) studies, the identification of any potential modifications to Appendix 26, without modifying the existing area allotments in recognizing f), and while taking into account that the current use of the narrowband systems shall remain unchanged and shall not be impacted nor precluded by the revision of Appendix 26.

PRELIMINARY VIEWS

This agenda item does not involve broadcasting service for the time being.

Project Topic 4: **to consider developing power flux-density and equivalent isotropically radiated power limits for inclusion in Article 21 of the Radio Regulations for the fixed-satellite, mobile-satellite and broadcasting-satellite services to protect the fixed and mobile services in the frequency bands 71-76 GHz and 81-86 GHz, in accordance with Resolution 775 (Rev.WRC-23)(WRC-27 AI 1.10)**

Project Manager: **Dr Li Leilei**
Co- Project Manager:
Time Period: **November 2023 to September 2024**

The following tasks were considered for this project:
1. Follow developments of studies in WP 5C to identify and possible impact on Broadcasting Services.
2. Possible impact on broadcasting services.

This report was provided by Dr. Li Leilei

BACKGROUND

Working Party 5C has been identified as a "Responsible group" for WRC-27 agenda item 1.10. The first meeting has already been held. The meeting drafted the working plan and liaison statement. The task of Working Party 5C is to complete the appropriate studies to determine power flux-density (pfd) and equivalent isotropically radiated power (e.i.r.p.) limits to be included in Article 21 for satellite services (fixed-satellite service (FSS), mobile-satellite service (MSS) and broadcasting-satellite service (BSS)) to protect the current and planned fixed and mobile services in the frequency bands 71-76 GHz and 81-86 GHz.

PRELIMINARY VIEWS

On the one hand, this agenda item will directly study and determine the power flux density and equivalent omnidirectional radiated power of satellite broadcasting services, and at the same time consider the protection of terrestrial broadcasting services. Therefore, it is necessary to pay attention to the positions and viewpoints of relevant countries in the world.

Project Topic 5: **to consider studies on possible new allocations to the mobile-satellite service for direct connectivity between space stations and International Mobile Telecommunications (IMT) user equipment to complement terrestrial IMT network coverage, in accordance with Resolution 253 (WRC-23)(WRC-27 AI 1.13)**

Project Manager: **Dr Li Leilei**
Co- Project Manager:
Time Period: **November 2023 to September 2024**

The following tasks were considered for this project:
1. Follow developments of studies in WP 4C to identify and possible impact on Broadcasting Services.
2. Possible impact on broadcasting services.

This report was provided by Dr Li Leilei

BACKGROUND

Working Party 4C has been identified as a "Responsible group" for WRC-27 agenda item 1.13. The first meeting has already been held. The meeting drafted the working plan and liaison statement. But it was decided to discuss the compiled sharing & compatibility study and MSS parameter document in the next meeting. The tasks of Working Party 4C are shown as follows:

1. Studies on possible allocations to the MSS in the frequency range between 694/698 MHz and 2.7 GHz, taking into account the IMT frequency arrangements addressed in the most recent version of Recommendation ITU-R M.1036.
2. Studies on spectrum requirements and on technical, operational and regulatory matters related to the implementation of the mobile-satellite service for direct connectivity to the IMT user equipment to complement the terrestrial IMT network coverage.

PRELIMINARY VIEWS

This agenda item will study the new possible allocation of satellite mobile services in the 694/698 MHz-2.7GHz band to achieve direct connection between space radio and IMT user equipment to supplement IMT terrestrial network coverage, involving the allocation of terrestrial broadcasting services in the 694-702MHz band. If approved, the issue will affect several services used by Asia-Pacific countries in this frequency band. Therefore, it is necessary to pay attention to the positions and viewpoints of relevant countries in the world, study the strategies and positions of participating in corresponding international conferences, and prevent the formation of adverse international restrictions on the development of terrestrial television services in the Asia-Pacific region.

Project Topic 6: **to consider regulatory provisions for receive-only space weather sensors and their protection in the Radio Regulations, taking into account the results of ITU Radiocommunication Sector studies, in accordance with Resolution 682 (WRC-23)(WRC-27 AI 1.17)**

Project Manager: **Dr Li Leilei**
Co- Project Manager:
Time Period: **November 2023 to September 2024**

The following tasks were considered for this project:
1. Follow developments of studies in WP 7C to identify and possible impact on Broadcasting Services.
2. Possible impact on broadcasting services.

This report was provided by Dr Li Leilei

BACKGROUND

Working Party 7C has been identified as a "Responsible group" for WRC-27 agenda item 1.17. The first meeting has already been held. The meeting drafted the working plan and liaison statement. But it was decided to discuss the compiled sharing & compatibility study and MSS parameter document in the next meeting. The tasks of Working Party 7C are shown as follows:

1. Studies on spectrum needs and appropriate protection criteria for receive-only space weather sensors, as well as system characteristics, as appropriate, taking into account noting a).
2. Sharing and compatibility studies pertaining to potential new primary allocations to MetAids (space weather) in the following frequency bands for receive-only sensors, taking into account resolves 2:
   – 27.5-28.0 MHz;
   – 29.7-30.2 MHz;
   – 32.2-32.6 MHz;
   – 37.5-38.325 MHz;
   – 73.0-74.6 MHz;
   – 608-614 MHz.
3. Studies on possible regulatory provisions of the Radio Regulations to accommodate the possibility for an administration that desires to notify a receive-only space weather sensor station to be included in the Master International Frequency Register.

PRELIMINARY VIEWS

This agenda item relates to the allocation of terrestrial broadcasting services in the 608-614 MHz band, so it is necessary to pay attention to the positions and views of relevant countries in the international community. ■

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While it primarily targets engineers, it also features general interest news stories. It contains articles on new technologies, developments in broadcasting, member innovations, and other materials of interest to engineers.

Your article can be of any length and written in any style. Should you include photos, please ensure they are high resolution (at least 2 megapixels). Although we cannot offer payment, we do provide a free half-page advertisement for select articles, especially those covering technical research. This advertisement will be placed immediately after your article, giving your organisation extra publicity.

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We look forward to considering your submission. If you need more information, please contact: balqis@abu.org.my

TOPIC CHAIRMAN'S REPORT FOR THE PERIOD MAY-OCTOBER 2024

TOPIC AREA: TRAINING & SERVICES

Topic Chairman: Padarabinda Das

1. The broadcasting landscape is constantly evolving, fuelled by technological advancements and a heightened emphasis on sustainable practices. Artificial Intelligence (AI) has emerged as a transformative force in the industry, offering a range of applications that enhance efficiency, personalize content, and streamline production processes. In addition, broadcasting is becoming increasingly immersive through technologies such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). Live events, sports, and entertainment can now be experienced in a more interactive and engaging way. These immersive technologies are also enhancing advertising efforts by creating captivating and interactive campaigns.

2. As new technologies emerge, industry professionals must continually update their skills to remain relevant. The shift from traditional broadcasting to digital platforms, the rise of streaming services/OTT, the adoption of 4K/8K technologies, integration of AI based applications, etc. are driving the need for training in the latest tools and techniques.

3. Moreover, the increasing demand for diverse and localized content has heightened the need for trained professionals who understand the cultural nuances and preferences of different markets within the Asia-Pacific region. This necessitates specialized training programs to develop skills in content creation, adaptation, and localization.

4. The expansion of the broadcasting sector further contributes to the demand for skilled personnel. As more channels, platforms, and production houses emerge, there is a growing need for a competent workforce to meet the demands of a competitive and evolving market. This imposes a significant challenge for the ABU Technology Division in addressing the training needs of its members, given the region's diverse adoption of technological innovations.

5. The Training & Services Topic Area plays a crucial role in assisting the ABU Technology Division in developing the technical skills and knowledge of ABU members through various approaches such as collaborations, MoUs, industry involvement, process streamlining, and understanding members' needs. To address these needs, the Topic Area has identified the following project topics:
   i) Technical Training Priorities and Members' Requirements (TS/TTPMR)
   ii) Skill Development Programme for Managerial and Occupational Safety (TS/SDPMOS)
   iii) Technical Skill Building and Knowledge Sharing (TS/TSBKS) or High-Tech Exposure & Knowledge Sharing (TS/TEKS)

   Some of the tasks and deliverables under these projects are routine and are being carried out periodically. The ABU Technology Division has been consistently working on these tasks on a regular basis.

6. The status of project topics including Action Taken Report (ATR) in respect of each project during the period May 2024 to Oct 2024 has been consolidated and given below:

a) Technical Training Priorities and Members Requirements (TS/TTPMR)

	TASKS	ACTION TAKEN REPORT/PRESENT STATUS
i	Conduct surveys periodically to understand the requirements and priority areas of members	ABU Technology Division conducts the survey every 2 to 3 years. The last survey was conducted during 8-22 October 2021. Based on the survey inputs the training requirements have been shortlisted and prioritised. However, the subsequent survey is long overdue and ABU TD may take up this task on priority and may complete it by early 2025.
ii	Identify requirement of Technical Advisory Services for Members	Status of ABU TAS missions : - TAS mission with VOV: ABU Technology has planned a technical advisory service for the Vietnamese broadcaster related to building its National Online Radio platform. A workshop was conducted on 12.7.2024 during Vietnam National Radio Festival to help overcome challenges from the digital transformation and to support building the platform for the broadcaster. Experts from NHK - Japan and RTM. - Malaysia shared international experiences on the application of digital transformation and Artificial Intelligence (AI) in program production & distribution. However, ABU TD may extend more such TAS missions as members immensely benefit from such initiatives.
iii	Joint activities with ABU Media Academy (AMA)	Over the course of the year, Media Academy organized a total of 43 online and offline training sessions. Among these, following two workshops focused on technology updates conducted: - Exploring TVU's Remote Production Solutions – Subodh Aggarwal (TVU).

	TASKS (CONT'D)	ACTION TAKEN REPORT/PRESENT STATUS (CONT'D)
iv	Collaborate with other established Media Training Academies	Details of collaborated training activities undertaken/ in pipeline : i) Academy of Broadcasting Science (ABS) NRTA-China and ABU Media Academy conducted 'Third Generation AVS Video Coding Standard (AVS3): Features and Applications' on 9th April 2024 benefiting about 60 participants representing over 35 ABU Member and non-member organizations. ii) A Technical Workshop on DAB+ Digital Radio from 23 - 25 July 2023 was conducted by ASBU and WorldDAB and hosted by ABU Technology benefiting about 259 participants, among them, 73 participants represented from 30 ABU Member organisations. iii) ABU-IPPTAR Workshop on Cloud Services and Remote Tools for Broadcaster is scheduled to be held from 26-28 November 2024 in Angkasapuri, Kuala Lumpur in partnership with IPPTAR.

b) Skill Development Programme for Managerial, and Occupational Safety (TS/ SDPMOS)

	TASKS	ACTION TAKEN REPORT/PRESENT STATUS
i	Identify and develop training programmes for non-technical, managerial, financial and occupational safety and skills enhancement	Details of non-technical training programmes completed and ongoing this year as a series through AMA: - Are being planned.

c) Technical Skill Building and Knowledge Sharing (TS/TSBKS)

	TASKS	ACTION TAKEN REPORT/PRESENT STATUS
i	Work with industry partners and international events to identify applicable training opportunities available in broadcasting field eg: ITU, IABM, SMPTE etc.	i) Several Workshops organised during the DBS2024 jointly with international standard bodies/ Industry partners. ii) Status on partnership with international organizers related to training: - A MoU signed with Korea Radio Promotion Association (RAPA) during GA in Seoul for Korean Government ODA assistance to ABU Members. Bangladesh Betar and VBTC, Vanuatu selected for the 2025-2026 ODA assistance. Official Letter of Intention for Cooperation and 'Project Concept Paper' from the selected ABU Members to be prepared and communicated to Line ministry in South Korea.

7. In addition to above, Tasks and deliverables, which are routine in nature, are being carried out on regular basis. Further, ABU Technology organised various webinars and physical workshop since last GA and the activities will be covered in **TD Director's Technical Activity Report** for presentation at the TBM/ TC meeting.

8. Following activities are proposed to be undertaken during November 2024 - October 2025:

	PROJECT TOPIC	DELIVERABLES
i	Technical Training Priorities and Members Requirements TS/TTPMR	a) Survey for Technical Training Needs. b) Database of training academies and training programmes offered by them. c) Database of Production/ B'cast Technology / equipment used by Members. d) Implementation of more TAS missions.
ii	Skill Development Programme for Managerial, and Occupational Safety TS/ SDPMOS	a) Survey for Technical Training Needs. b) Database of training academies and training programmes offered by them. c) Database of Production/ B'cast Technology / equipment used by Members. d) Implementation of more TAS missions.
iii	Technical Skill Building and Knowledge Sharing TS/TSBKS	a) More MoU with Industry Partners. b) Creation of Members' Information Exchange platform.

9. Project Managers and Co-Project Managers may be requested to contribute for Project Topics under this Topic Area. Their active participation and contribution may help achieving the targets and deliverables timely. ■

REPORT OF TOPIC CHAIRMAN

TOPIC AREA: DISTRIBUTION

Topic Chairman: **Hirokazu Kamoda (NHK)**
Period of Report: **November 2023 to September 2024**
Date of Report : **30 September 2024**

Introduction:
Distribution topic area comprises four projects. The matters concerning digital terrestrial television broadcasting, digital satellite broadcasting, and digital sound broadcasting are studied or investigated by these projects. This topic area also covers research on IBB and OTT, including platforms and standards, etc.

1. NEXT GENERATION TERRESTRIAL BROADCASTING (D/NGTB)

Project Manager: **Dr Shingo Asakura** (NHK, Japan)
Co-project Manager: **Dr Jeon Sungho** (KBS, Korea)
Mr Chen Delin (ABS, China)
Mr Halil Us (TRT, Turkey)
Mr M S Duhan (DDI, India)
Mr Rajesh Meena (India)
Mr A K Mangalgi (DDI, India)
Mr Zhang Yu (ABS, China)
Mrs Xiao Jingting (ABS, China)

Reports from the project manager and the contributors are as follows:

1.1 Efforts Toward the Realization of Next Generation Terrestrial Broadcasting in Japan
1.2 Development of ATSC 3.0 & 5G-Broadcbast Transmission Techniques in the Republic of Korea
1.3 Other Topics on Next Generation Terrestrial Broadcasting

The reports for D/NGTB are attached as Annex 1.

2. INTEGRATED BROADCAST-BROADBAND AND OTT (D/IBBOTT)

Project Manager: **Dr Go OHTAKE** (NHK, Japan)
Co-project Manager: **Mr A. K. Mangalgi** (DDI, India)
Mr R.P. Joshi
Dr Hirokazu Kamoda (NHK, Japan)
Mr Hiroki Endo (NHK, Japan)
Mrs Zhang Dingjing (ABS, China)
Zhang Yu (ABS, China)
Zhang Wei (ABS, China)
He Jing (ABS, China)
Wang Lei (ABS, China)

Reports from the project manager and the contributors are as follows:

2.1 Standardization of Integrated Broadcast-Broadband System in Japan
2.2 Studies in ITU-R
2.3 Studies in ITU-T
2.4 Topics on Cybersecurity

The reports for D/NGTB are attached as Annex 2.

PROJECT: NEXT GENERATION TERRESTRIAL BROADCASTING (D/NGTB)

Project Manager: **Dr Shingo Asakura** (NHK, Japan)
Co-project Manager: **Dr Jeon Sungho** (KBS, Korea)
Mr Chen Delin (ABS, China)
Mr Halil Us (TRT, Turkey)
Mr M S Duhan (DDI, India)
Mr Rajesh Meena (India)
Mr A K Mangalgi (DDI, India)
Mr Zhang Yu (ABS, China)
Mrs Xiao Jingting (ABS, China)

1.1 EFFORTS TOWARD THE REALIZATION OF NEXT GENERATION TERRESTRIAL BROADCASTING IN JAPAN

1.1.1 INTRODUCTION

An advanced digital terrestrial TV broadcasting system (Advanced ISDB-T) has been developed in Japan. Advanced ISDB-T inherits the segment structure of Integrated Services Digital Broadcasting-Terrestrial (ISDB-T), which can simultaneously provide services for mobile reception and fixed reception in one channel. Advanced ISDB-T also uses low-density parity-check (LDPC) code for forward error correction and also has a low coding rate. Therefore, it is possible to use transmission parameters with a required C/N that is 10 dB smaller than that of current broadcasting for mobile reception in Japan.

ISDB-T mobile reception services in Japan are widely used in car receivers. However, it may not be possible to receive signals correctly in areas far from the transmitting station or in areas where the field strength is low, such as behind buildings or under elevated roads. In broadcasting, retransmission is not used as in communications. Therefore, if the reception is not correct, the video content and audio content will be interrupted. This leads to a decrease in the viewer's desire to watch content. To provide uninterrupted mobile reception, a scheme for transmitting audio content independently by using highly robust transmission parameters is evaluated. The reason for transmitting only audio content using highly robust transmission parameters is that discomfort would be alleviated even if the video was interrupted and the content could be conveyed through audio content. Furthermore, the amount of information in audio content is only a few percent of the total signal, but the amount of information in video content is the majority of the total signal. Therefore, when video content is transmitted using highly robust transmission parameters, a larger transmission band is required.

This report describes the results of field experiments evaluating the reception performance when audio content was transmitted using the most robust transmission parameters in Advanced ISDB-T. Using a large-scale experimental station with a transmission power of 1 kW, measurements were carried out in a wide area including various reception environments such as urban areas and expressways.

1.1.2 OVERVIEW

1.1.2.1 FEATURES OF ADVANCED ISDB-T

The segment structures of ISDB-T and Advanced ISDB-T are shown in ***Figure 1***. In ISDB-T, the transmission bandwidth in one channel is divided into 13 segments; the central segment is used for mobile reception services, and the other 12 segments are used for fixed reception service. In Advanced ISDB-T, the transmission bandwidth in one channel is divided into 35 segments; the central 9 segments are called "partial reception band." The number of segments for mobile services in the partial reception band can be up to 9 segments (a narrow-band receiver can receive only 9 segments for partial reception).

TABLE 1 lists the transmission parameters of Advanced ISDB-T and ISDB-T. To increase the transmission capacity, transmission parameters, such as occupied bandwidth, fast Fourier transform (FFT) size, and carrier modulation scheme, forward error correction of Advanced ISDB-T are modified from those of ISDB-T. Advanced ISDB-T system has a new signal frame structure that enables bandwidth to be flexibly allocated to multiple services for different reception scenarios, such as fixed reception and mobile reception, compared with ISDB-T. The following are documents to help you get more information about Advanced ISDB-T:

- A Study on the Transmission System of an Advanced ISDB-T
  https://ieeexplore.ieee.org/document/8971915
  This report describes an overview of the transmission system for a next-generation DTTB called Advanced ISDB-T and its basic transmission performance.
- Transmission System Design of UHD-1/4K and UHD-2/8K Terrestrial Television Broadcasting and its Performance Proof by Large-Scaled Field Experiments SMPTE Motion Imaging Journal, Vol.129, No.6, pp.35-42, Jul. 2020.
  This paper presents the concept and specifications of the proposed system. The verification results of a computer simulation, and laboratory and large-scale field experiments are also described.
- Fixed Reception Performance of FDM-based Transmission System for Advanced ISDB-T
  https://www.set.org.br/ijbe/ed6/Artigo1.pdf
  This paper provides a BICM selection guideline based on the simulation results for fixed reception scenarios toward the practical application of Advanced ISDB-T.

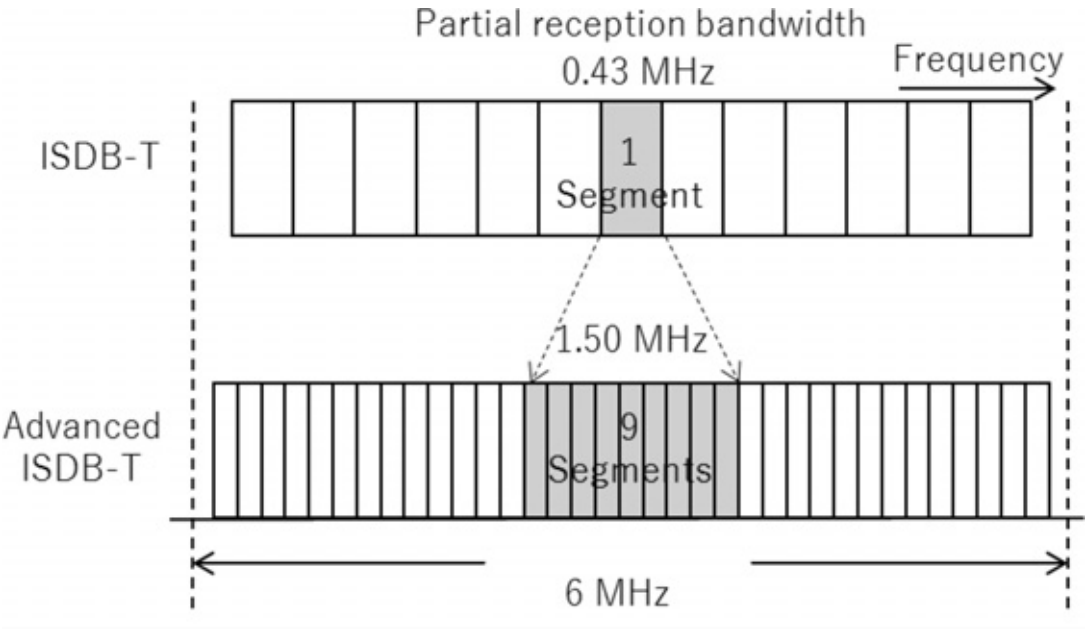


Figure 1. *Segment structure of ISDB-T and Advanced ISDB-T*

TABLE I. Transmittion Parameters

	Advanced ISDB-T			ISDB-T		
Channel bandwidth	6 MHz			6 MHz		
Occupied bandwidth	5.83 MHz			5.57 MHz		
FFT sample frequency	512/81 = 6.320... MHz			512/63 = 8.126... MHz		
FFT size	8,192 (8k)	16,384 (16k)	32,768 (32k)	2,048 (2k)	4,096 (4k)	8,192 (8k)
Useful OFDM symbol duration	1,296 μs	2,592 μs	5,184 μs	252 μs	504 μs	1,008 μs
Total number of carriers	7,561	15,121	30,241	1,405	2,809	5,617
SP ratio	33.3 %, 16.7 %, 8.3 %, 4.2 %, 2.1 %			8.3 %		
GI ratio	1/4, 1/8, 1/16, 1/32, 1/64, 800/N_{FFT}※1, 1600/N_{FFT}※1			1/4, 1/8, 1/16, 1/32		
Carrier modulation scheme	QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM QPSK gives a uniform constellation. 16 to 4,096 QAM give a non-uniform constellation.			QPSK, 16QAM, 64QAM		
Inner code (coding rate)	LDPC code (2/16 - 14 /16)			Convolutional code (1/2, 2/3, 3/4, 5/6, 7/8)		
Outer code	BCH code			RS code		

※1: N_{FFT} represents the FFT size.

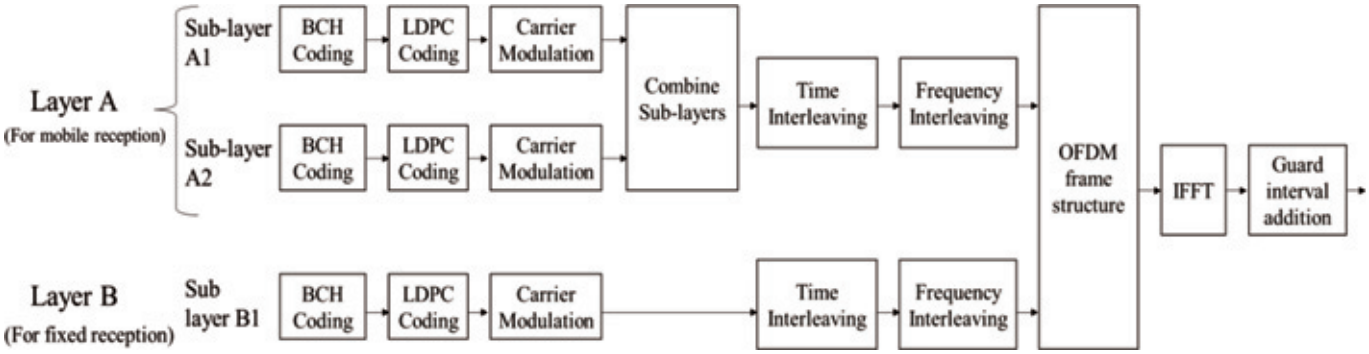


***Figure 2**. Transmission block diagram*

1.1.2.2 TRANSMISSION SCHEME FOR HIGHLY ROBUST MOBILE RECEPTION

Figure 2 shows transmission block diagram of the transmission encoding process. As mentioned above, Advanced ISDB-T consists of 35 segments, and hierarchical transmission is possible in units of segments. Services for different reception scenarios, such as mobile reception and fixed reception, are distinguished at the layer levels such as A and B. Furthermore, each layer can be divided into sub-layers with one-third of a segments as a unit. Content such as video content and audio content can be distinguished at sub-layers levels such as A1 and A2. ***Figure 2*** also shows an example in which the layer for mobile reception (layer A) is configured into two sub-layers, one for audio content (sub-layer A1) and one for video content (sub-layer A2). The carrier modulation scheme and LDPC coding rate, which are transmission parameters related to robustness, can be set for each sub-layer. Therefore, audio content (sub-layer A1) can be transmitted using more robustly parameters than that for video content (sub-layer A2). On the other hand, transmission delays between the two sub-layers need to be matched for synchronizing video content and audio content. Therefore, the time interleaving, which is a transmission parameter related to delay, is common between sub-layers.

1.1.3 FIELD EXPERIMENTS

1.1.3.1 OVERVIEW

To evaluate the mobile reception performance of Advanced ISDB-T, field experiments were conducted using the Shiba experimental station in Tokyo. The radio waves from the experimental station were received in a moving measurement vehicle. **TABLE II** summarizes the specifications of the experimental station, and **TABLE III** shows the transmission parameters of the field experiments.

TABLE II. Specifications of experimental station

Tx site	Shiba (Minato-ku, Tokyo)
Tx channel (Center frequency)	UHF 28ch in Japan (563.142857 MHz)
Tx power	1.0 kW
Polarization	Horizontal
Tx antenna height	280 m above sea level

TABLE III. Transmission parameters of field experiments

	Mobile reception		Fixed reception
	Sub-layer A1	Sub-layer A2	Layer B
FFT size	16384		
Useful OFDM symbol duration	2592 μs		
GI ratio	800 / 16384		
Number of segments	2	4	29
Carrier modulation	QPSK	16QAM-NUC	256QAM-NUC
LDPC code rate	2/16	7/16	12/16
Time interleave length	584 ms		282 ms
SP ratio	8.3 %		4.2 %
Transmission capacity	69 kbps	982 kbps	25.6 Mbps
Assuming content	Audio	Video + Audio	Video + Audio

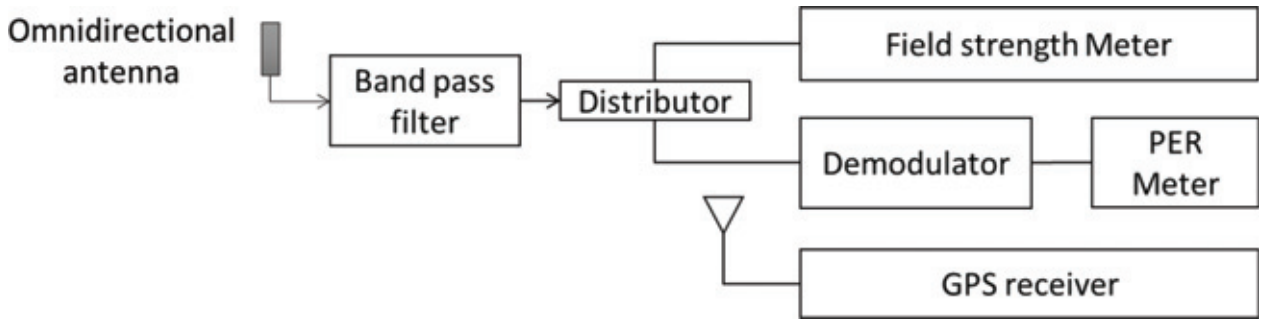


***Figure 3**. Reception system diagram for the receivers*

The evaluation was conducted assuming a service that uses two sub-layers for mobile reception, providing highly robust audio content services on sub-layer A1 and video content services on sub-layer A2. For sub-layer A1, the most robust transmission parameters in Advanced ISDB-T were used. For sub-layer A2, the transmission parameters of the required C/N, which are equivalent to the operated parameter for mobile reception in ISDB-T, were used. In this experiment, the transmission performances only for the mobile reception layer was evaluated. That is, the characteristics of the fixed reception layer were not evaluated.

The reception system diagram for the receivers installed on the measurement vehicle is shown in ***Figure 3***. Omnidirectional antennas were used for receiving. The antenna gain was -2.3 dBd and the height above the ground was approximately 2 m. Although the ***figure 3*** shows a reception system with a single receiving antenna, diversity reception using four receiving antennas was also evaluated. Also, the packet error rate (PER) per second was measured. A packet indicates a block of forward error correction. Errors in the packet were detected by parity check of the BCH code. Furthermore, information on the location and speed of the measurement vehicle obtained from GPS and the field strength were measured simultaneously. Here, one second's worth of measured data is called a sample. Samples that taken in the measurement vehicle when it was stationary, such as at traffic lights, were excluded from the measurement data. The total number of effective samples was about 53,613. The driving distance was about 550 km. ***Figure 4*** shows the measurement route and the field strengths on the route. The route included highways and urban areas. The dashed line in the figure indicates contour of the calculated field strength. ***Figures 5*** shows the distribution of field strength and moving speed. The maximum moving speed was 100 km/h.

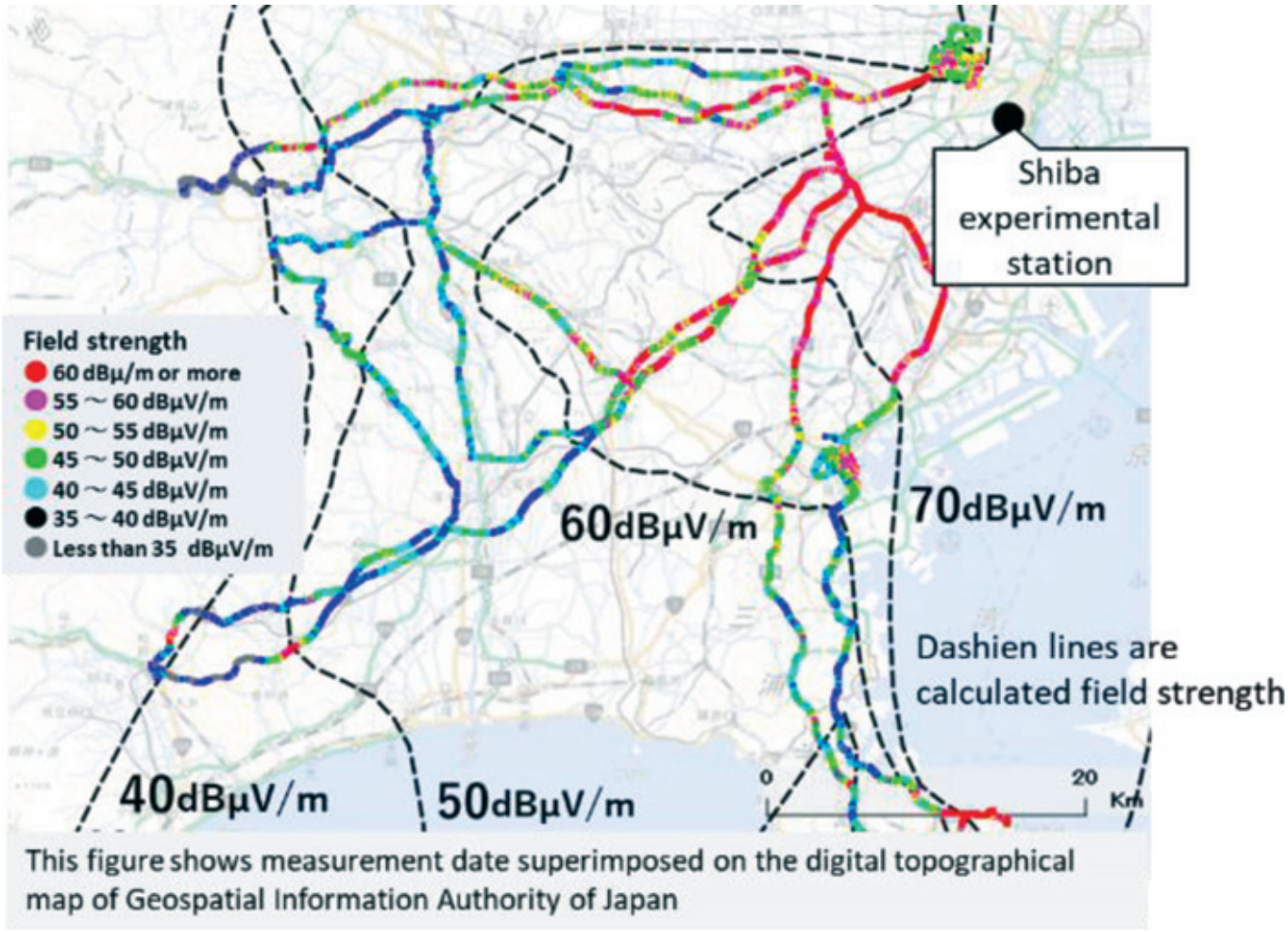
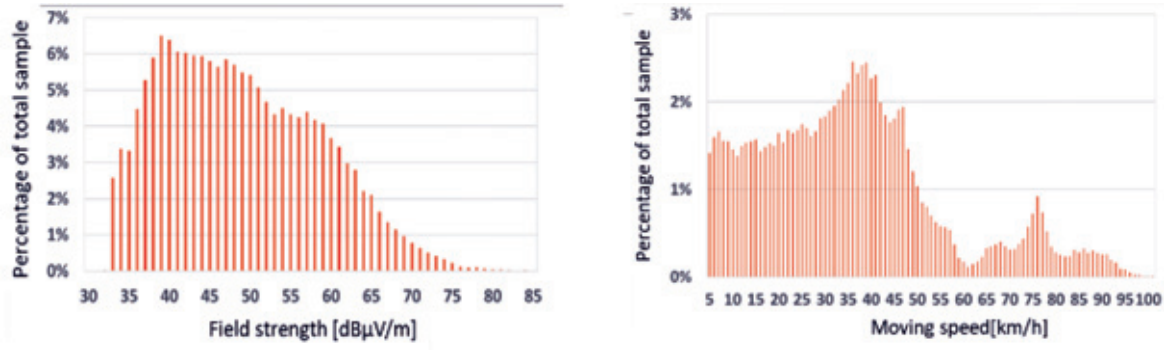


***Figure 4**. Measurement route and field strength on the route*



(a) Field strength

(b) Moving speed

***Figure 5**. Distribution of field strength and moving speed*

1.1.3.2 RESULTS OF RECEPTION SUCCEEDED OR FAILED

Figure 6 shows whether the reception succeeded or failed on the route. Reception succeeded indicates that the packet contains no error. The blue plot in the figure is the area where reception failed on sub-layer A2, but reception succeeded on sub-layer A1, indicating the area where audio content reception could continue. The results confirm that only sub-layer A1 can be received in areas where the calculated field strength is less than 60 dBμV/m, which is relatively far from the experimental station. As for the measurement results in urban areas,

Figure 7 shows the results around Shinjuku Station and Yokohama Station. The results confirm that, excluding tunnels, there are many areas where only the sub-layer A1 can be received, even in urban areas with many high-rise buildings.

Figure 8 summarizes the fluctuations in field strength and the reception succeeded or failed for each sub-layer when driving inside a tunnel close to the experimental station, where the effects of highly robust audio content transmission were noticeable. The field strength was decreased by more than 10 dB inside the tunnel due to shielding, and whereas errors caused reception to be interrupted on sub-layer A2, reception continued sub-layer A1.

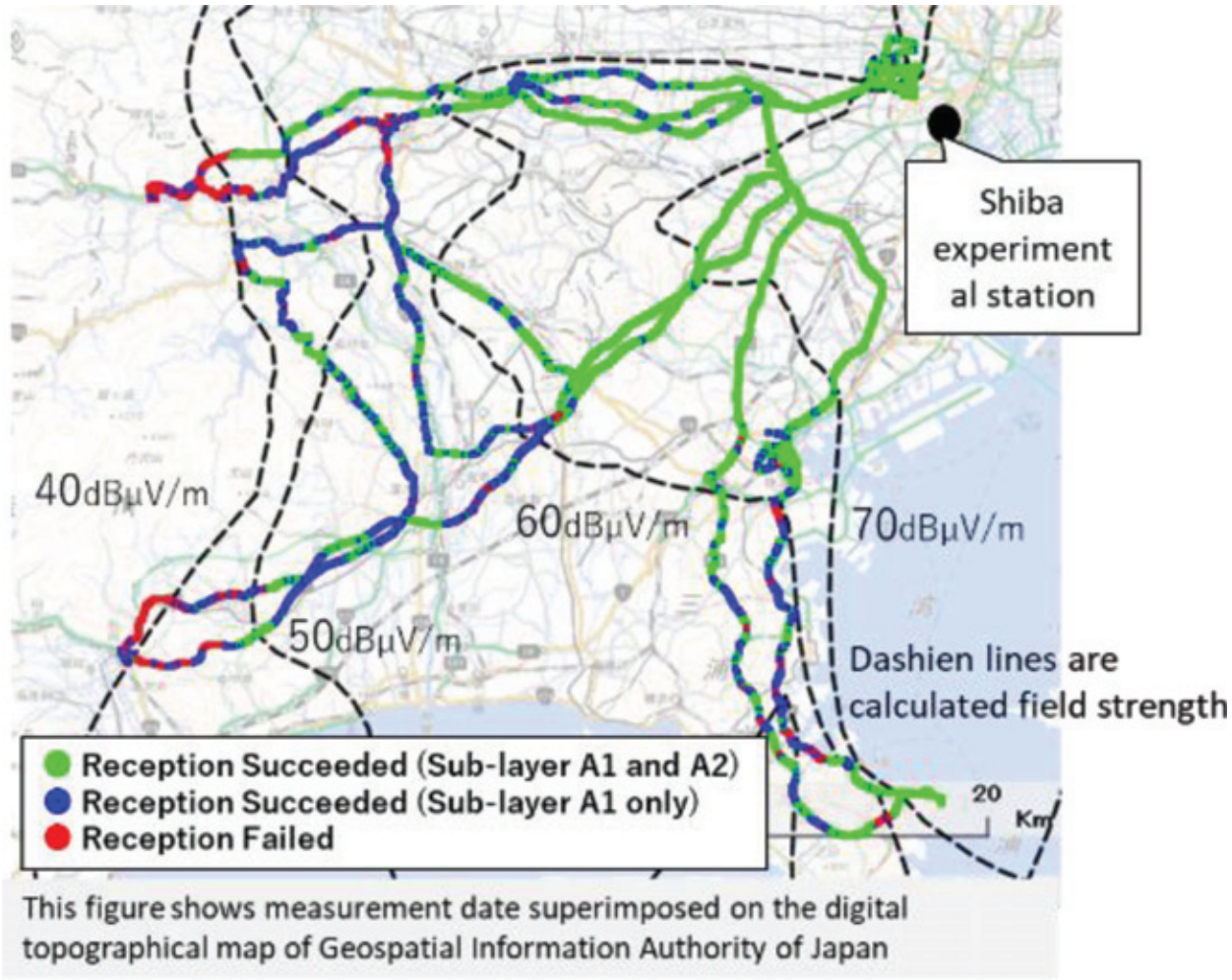
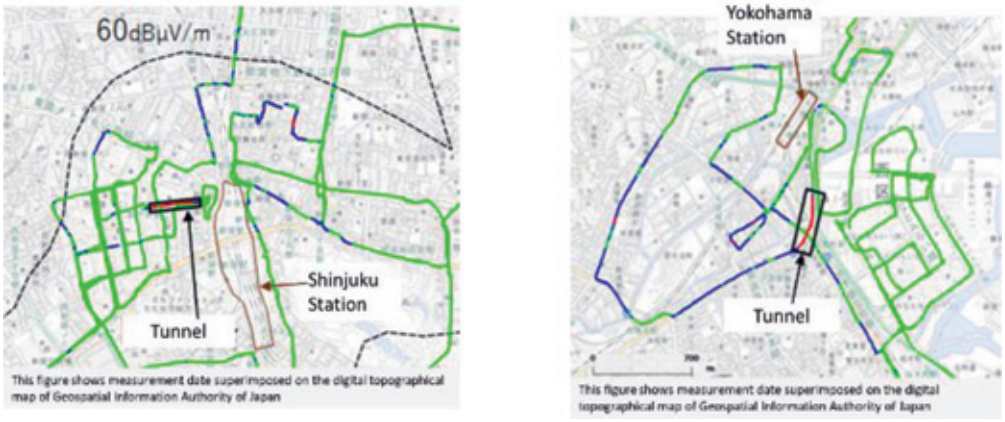


***Figure 6**. Reception succeeded or failed for each sub-layer*



(a) Around Shinjuku Station (b) Around Yokohama Station

Figure 7. *Reception succeeded or failed for each sub-layer (urban areas)*

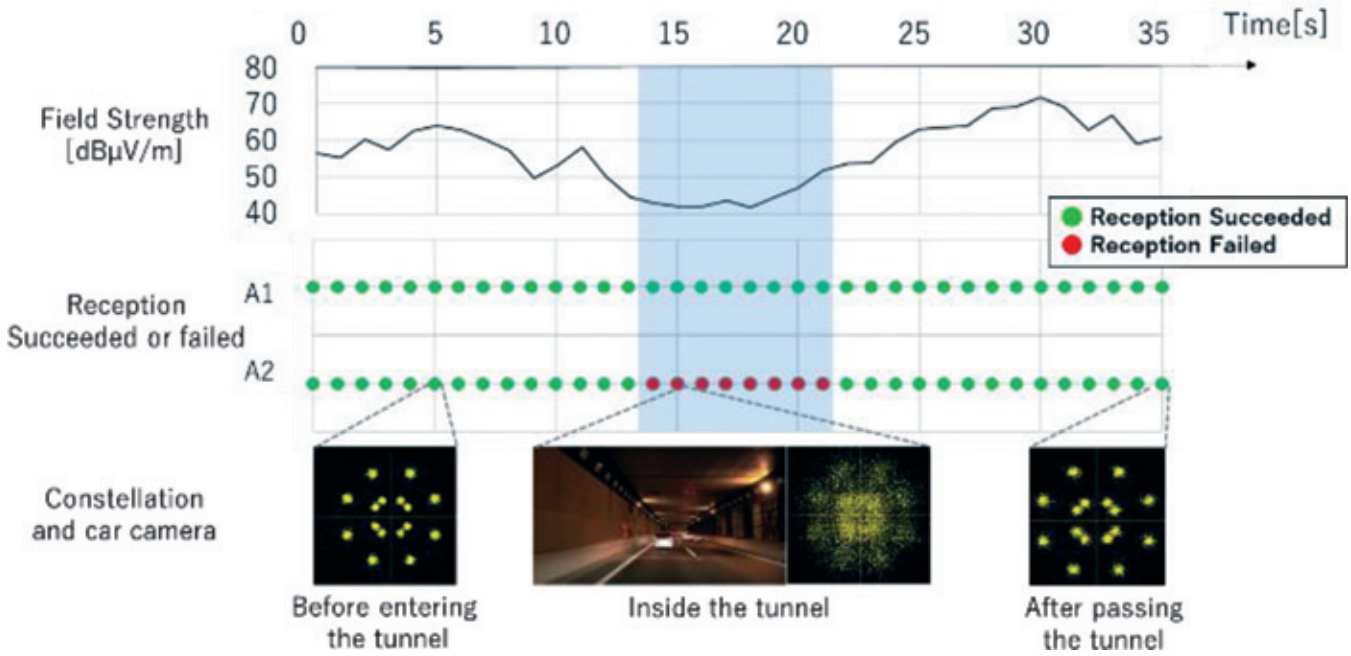


Figure 8. *Fluctuations in field strength and reception succeeded or failed for each sub-layer*

1.1.3.3 EVALUATION OF REQUIRED FIELD STRENGTH

Figure 9 is a stacked bar graph showing the distribution of field strengths in Figure 5 with colors indicating whether reception succeeded or failed. As shown, there were many samples where only sub-layer A1 could be received at low field strengths of 35 to 50 dBμV/m. Errors occurred in each sub-layer even when the field strength was relatively high. This is because if there is poor reception in a tunnel, it takes a certain amount of time to establish synchronization after passing through it.

Figure 10 plots the correct reception rate versus field strength. Here, the correct reception rate has the total number of samples for each field strength in the denominator and the number of correct reception samples in the numerator. The required field strength was set to achieve a correct reception rate of 95%. Comparing the required field strengths, it can be seen that sub-layer A1 is 11.0 dB lower than the sub-layer A.

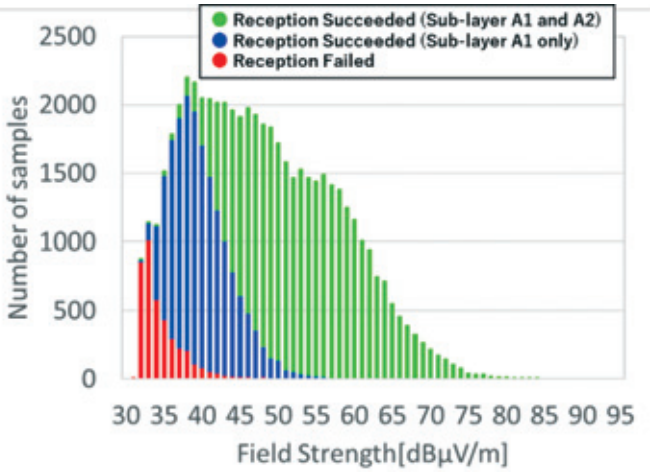


Figure 9. *Reception succeeded or failed for each field strength*

TABLE IV. Results of coverage area ratio

Areas	Range of calculated field strength [dBμV/m]	1 antenna		4 antennas	
		Sub-layer A1	Sub-layer A2	Sub-layer A1	Sub-layer A2
(a)	30 - 40	14 %	0 %	33 %	0 %
(b)	40 - 50	79 %	29 %	89 %	65 %
(c)	50 - 60	89 %	33 %	96 %	72 %
(d)	60 - 70	98 %	79 %	98 %	95 %
(e)	70 - 80	100 %	99 %	100 %	100 %

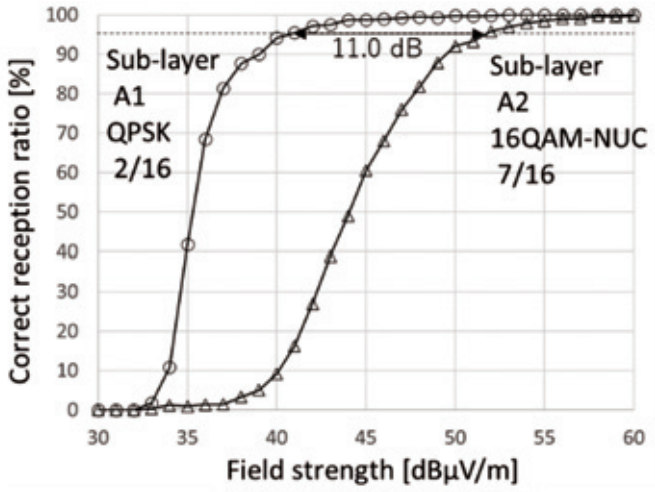


***Figure 10**. Correct reception rate versus field strength*

1.1.3.4 EVALUATION OF COVERAGE AREA RATIO

This section also describes the results of diversity reception. The case of diversity reception, the required field strength is lower than the received field strength that can be measured with the reception system for this filed experiment. Therefore, areas were divided based on the calculated field strength and the coverage area ratio within each area was evaluated.

The calculated field strength at a receiving antenna height of 10 m was divided into 10 dB steps from 30 to 70 dBμV/m, and the coverage area ratio was calculated for each sample included within the range. The measurement route was divided up into 20-m sections, and the sections where correct reception was possible were calculated as the coverage area ratio. Sections that contained error samples were defined as reception failures. **TABLE IV** shows the resulting coverage area ratios. Based on the results with a single receiving antenna, the coverage area ratio of sub-layer A1 was more than 50% higher than that of sub-layer A2 in area where the calculated field strength was 40 to 60. Therefore, reception using four receiving antennas made it possible to further improve the coverage area ratio with a lower field strength.

1.1.4 CONCLUSION

The mobile reception performance of Advanced ISDB-T was evaluated in field experiments. In order to verify a mobile reception service that can continue to receive audio content even when reception quality deteriorates, more robust transmission parameters were used for audio content transmissions than for video content. Sub-layer A1 used the most robust transmission parameters in Advanced ISDB-T, and sub-layer A2 used transmission parameters with a required C/N equivalent to that of current broadcasting. Measurements were made in a wide area including urban areas and highways using a large-scale experimental station with a transmission output of 1 kW. The coverage area ratio of sub-layer A1 where the calculated field strength is 50 to 60 dBμV/m was 89%, an improvement of 56% compared with sub-layer A2. In urban areas with many high-rise buildings, there were many areas where reception succeeded only on sub-layer A1, thereby confirming the effectiveness of robust audio content transmission.

This article was modified from the paper that was published in the proceedings of IEEE Vehicular Technology Conference (VTC) 2024-Fall.

H. Miyasaka, T. Takeuchi and M. Okano: "Field Experiments on Highly Robust Mobile Reception for Advanced ISDB-T," in Proc. IEEE Vehicular Technology Conference (VTC) 2024-Fall, Oct. 2024.

ACKNOWLEDGMENT

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1.2 DEVELOPMENT OF ATSC 3.0 & 5G-BROADCBAST TRANSMISSION TECHNIQUES IN THE REPUBLIC OF KOREA

Since December 2020, government-funded research projects aimed at developing innovative services based on ATSC 3.0 technology have been conducted, as outlined in the 'Policy Measures to Activate Terrestrial UHD Broadcasting' announced by the Ministry of Science and ICT and the Korea Communications Commission. These projects focus on three key areas: demonstrating the convergence of broadcasting and telecommunications, developing and demonstrating various technologies for mobile service reception, and developing 8K-UHD broadcasting technologies.

Since November 2020, when the KBS Gyeonggi Gamgaksan ATSC 3.0 Experimental Station was authorized, transmitters developed through government-funded research projects have been installed in stages at the station. Through high-power field tests, the projects have continuously verified and improved the performance of individual outputs. In June 2023, a seminar was held at the Bukgamgak Experimental Station and its coverage area (Jeokseong-myeon, Paju-si) with the participation of the ATSC President, Madeleine Noland, engineers from the three major Korean broadcasters (KBS, MBC, and SBS), and ETRI researchers. The seminar confirmed that Korea is indeed a global leader in ATSC 3.0 technology development.

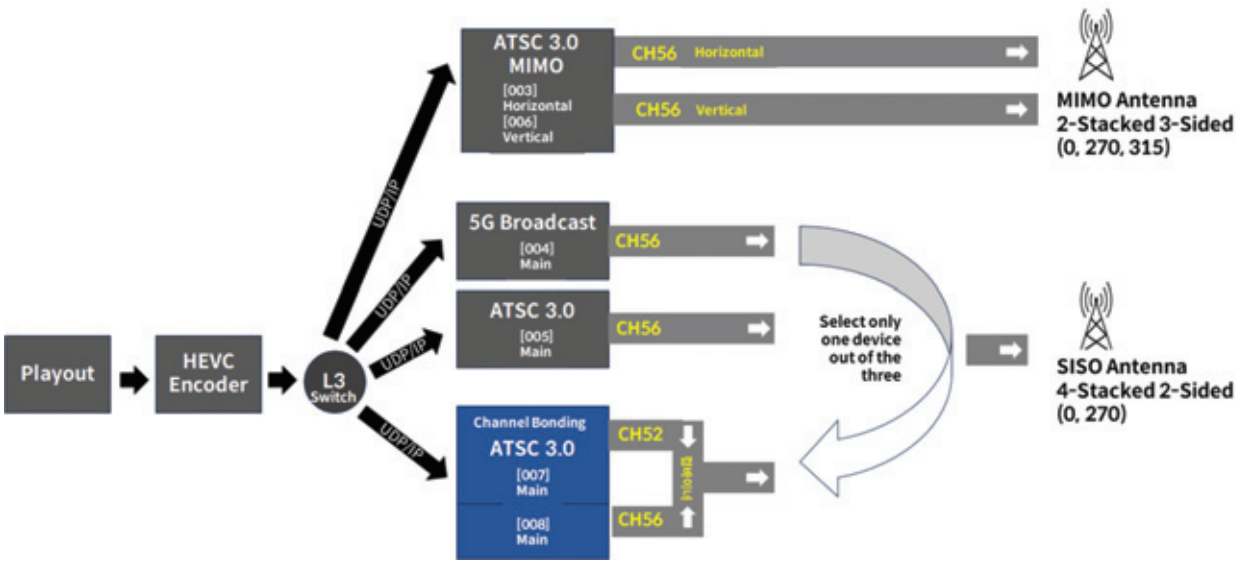
PROJECT TITLE	RESEARCH PERIOD	RESEARCH OBJECTIVES
Development of Integrated Transmission Technology for 5G and Terrestrial Broadcasting (ATSC 3.0)	April 2019 - December 2023	Development of a technology that simultaneously transmits fixed reception channels (ATSC 3.0 standard) and mobile reception channels (5G-FeMBMS standard) within a terrestrial UHD broadcast channel using time-division multiplexing (TDM).
Development of Terrestrial 8K Media Broadcast Transmission and Reception Technology	April 2022 - December 2026	Development of a transmission and reception system capable of delivering 8K-UHD media over terrestrial broadcast networks, supporting up to 200 Mbps, by utilizing 'channel bonding' and 'multi-antenna' technologies.
Development of ATSC 3.0 Mobile Broadcasting Receiver Chip	April 2023 - December 2026	Development and implementation of a high-performance, high-sensitivity mobile broadcast receiver chip supporting ATSC 3.0 standards. The chip will utilize multiple receive antennas and be integrated into a commercial-grade in-vehicle set-top box.

1.2.1 DEPLOYMENT AND UTILIZATION OF TRANSMITTERS AT THE EXPERIMENTAL STATION

PROJECT TITLE	EQUIPMENT AND CONFIGURATION
Integrated Transmission for 5G and ATSC 3.0	Unit #4 for 5G Broadcast and Unit #5 for ATSC 3.0; transmitters combined using time-division multiplexing (TDM) for a total output power of 900W.
Development of Terrestrial 8K Media Broadcast Transmission and Reception Technology	Units #3 and #6 (horizontal and vertical polarization); a single transmitter is used for both horizontal and vertical polarization with 300W MIMO transmission. Units #7 and #8 (horizontal channels 56 and 52) are used for channel bonding with a total power of 300W.
Development of ATSC 3.0 Mobile Broadcasting Receiver Chip	Unit #5 (ATSC 3.0); to enhance mobile reception performance, a 'diversity reception' technique utilizing up to four receive antennas is planned for verification.

Installation of ATSC 3.0 SISO and MIMO, Channel Bonding, and 5G-Broadcast Transmitters

Antenna installation on a transmission tower: SISO (top) and MIMO (bottom)



1.2.2 VERIFICATION OF DIRECT RECEPTION FOLLOWING INSTALLATION OF ATSC 3.0 CHANNEL BONDING TRANSMITTERS (UNITS 7 AND 8)

ATSC 3.0 channel bonding transmitters were installed, along with a channel combiner for CH52 and CH56 channels. A U-LINK was manually configured to transmit signals through an existing four-element, two-stacked, horizontally polarized antenna.

(a) Transportation and installation of ATSC 3.0 standard-compliant channel bonding transmitters.

(b) Custom fabrication of a stretched line combiner capable of combining CH52 and CH56 channels.

(c) Power activation of the transmitter connected to the U-LINK (prior to a test transmission at a rated output power of 400 W).

Through direct RF reception using an ATSC 3.0 channel bonding receiver installed in a field test vehicle, simultaneous reception of CH52 and CH56 channels was verified using two spectrum analyzers and a dedicated ATSC 3.0 channel bonding receiver.

(a) A field test vehicle equipped with an ATSC 3.0 standard-compliant channel bonding receiver was used for internal measurements.

(b) Simultaneous direct reception of CH52 and CH56 channels was confirmed using two spectrum analyzers and a dedicated ATSC 3.0 channel bonding receiver.

1.2.3 PERFORMANCE EVALUATION OF INTEGRATED ATSC 3.0 AND 5G-BROADCAST PHYSICAL LAYER TRANSMISSIONS BY FIELD MEASUREMENT CAMPAIGN

1.2.3.1 FIELD TEST MEASUREMENT VEHICLE AND TRANSMISSION PARAMETER CONFIGURATION

To evaluate the reception performance of integrated ATSC 3.0 and 5G-Broadcast physical layers, field tests were conducted using a dedicated measurement vehicle. The following configuration was employed:

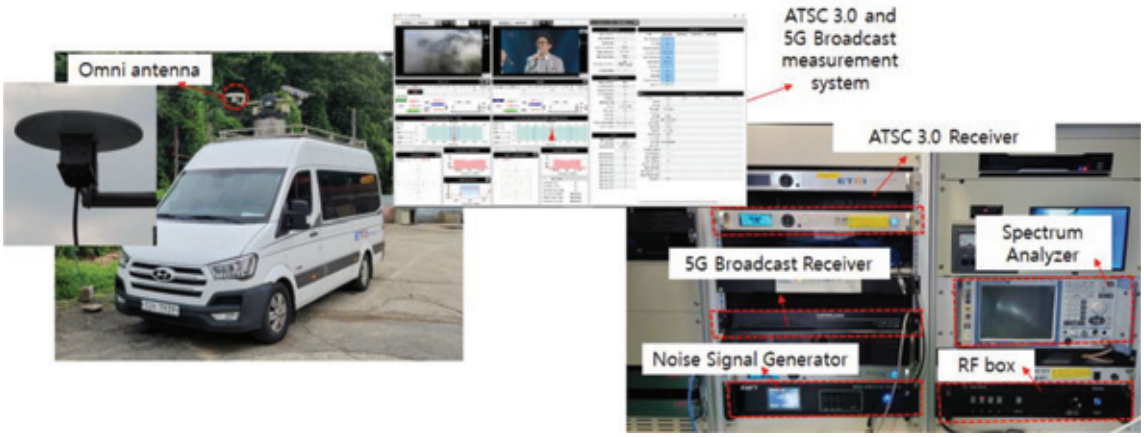
- Transmission:
  - o A time division multiplexing (TDM) scheme was utilized to transmit signals from ATSC 3.0 transmitter

(Unit#5) and 5G-Broadcast transmitter (Unit#6) operating in the licensed 768 MHz frequency band with a 6 MHz bandwidth, adhering to respective standards.

- Reception:
  - o An omnidirectional antenna was installed on the measurement vehicle to receive signals directly from the experimental station. A professional receiver equipped with signal analysis capabilities was also installed for in-depth analysis.
  - o To ensure a fair and objective comparison of the performance of different physical layer standards, detailed transmission parameters were configured as shown in [Table] under identical data rate conditions. Specifically, Configurations #1 and #2 were set to 5 Mbps and 8 Mbps, respectively.

ATSC 3.0 Configuration			
Resource	Bandwidth	6 MHz	
	Time resource	50% (200msec)	
Payload OFDM parameters	FFT size	8192	
	Guard interval	GI6_1536(222.22us)	
	Subcarrier spacing	0.844 kHz	
	Pilot pattern	SP4_2	
	Time interleaver	CTI with a depth of 1024	
	Frequency interleaver	On	
Payload Encoding parameters	**Configuration**	**#1**	**#2**
	Outer code	7/15 LDPC(64800)	10/15 LDPC(64800)
	Constellation	64-NUC	64-NUC
	Data rate	5.77 Mbps	8.23 Mbps

5G Broadcast Configuration			
Resource	Bandwidth	6 MHz (30RBs)	
	Time resource	50% (200msec)	
Payload OFDM parameters	FFT size	12288	
	Guard interval	200 us	
	Pilot pattern	SP3_2	
	Subcarrier spacing	1.25 kHz	
Payload Encoding parameters	**Configuration**	**#1**	**#2**
	MCS index	19	24
	Code rate	0.498	0.764
	Constellation	64-QAM	64-QAM
	Data rate	5.21 Mbps	8.00 Mbps

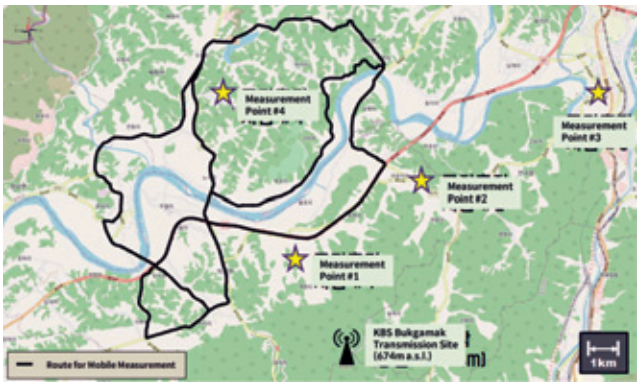


1.2.3.2 FIELD TEST RESULTS: FIXED AND MOBILE MEASUREMENTS OF ATSC 3.0 AND 5G-BROADCAST CONVERGENCE TRANSMISSION

1.2.3.2.1 FIXED MEASUREMENT RESULTS

- Measurement Points: Four reception points were selected, considering direct reception environments such as Line-of-Sight (LoS) availability and multipath conditions based on terrain profile analysis.

- Measurement Range: The entire physical layer signal was measured, including data transmission channels and control channels.



- Measurement Criteria: The ToV (Threshold of Visibility) was defined as the CNR required to achieve a BLER = 10^{-4}. ToV is the minimum signal quality metric for satisfactory viewing [BT.2252].

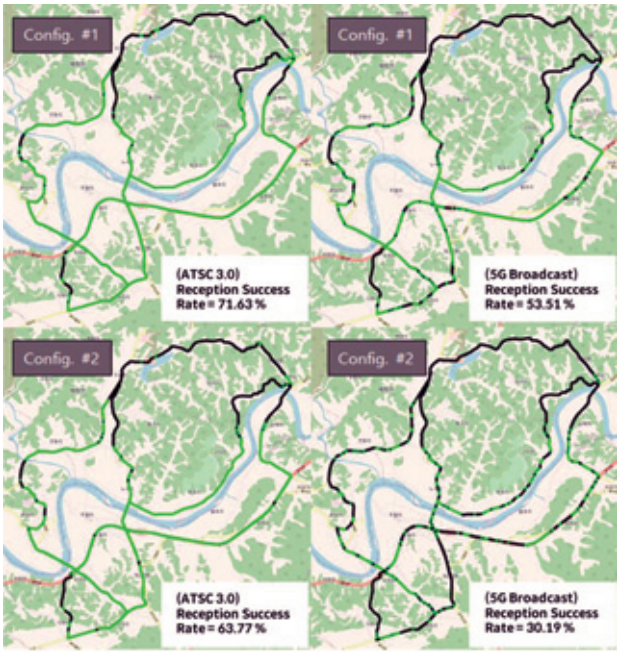
* *ToV CNR refers to the minimum ratio of received signal strength to noise required for satisfactory viewing. Therefore, a lower ToV CNR value indicates that satisfactory viewing is possible even in a poorer reception environment. When comparing systems, a lower required ToV value indicates that the system has a comparative advantage.*

- Results: The received field strength (dBm) and ToV CNR (dB) for each standard were measured at each fixed measurement point.

1.2.3.2.2 MOBILE MEASUREMENT RESULTS

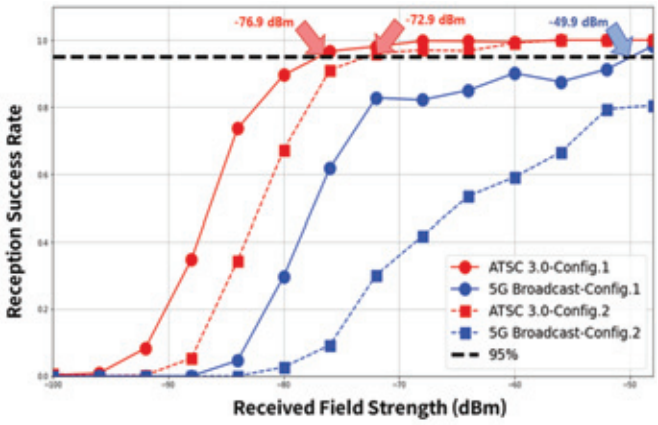
Mobile measurements were conducted by repeatedly traversing the same route within the broadcasting area of the experimental station at a constant speed. Thanks to time-division multiplexing, measurements for each standard were conducted simultaneously.

- Result 1: Reception Success Rate For each reception point, locations where signals were successfully received were marked in green on the map, and locations where reception failed were marked in black.
  - o [Configuration #1] ATSC 3.0 achieved a reception success rate of 71.63%, while 5G Broadcast achieved 53.51%.
    - For 5G Broadcast, reception failures were observed even in open areas with line-of-sight.
  - o [Configuration #2] ATSC 3.0 achieved a reception success rate of 63.77%, while 5G Broadcast achieved 30.19%.
    - For 5G Broadcast, reception failures were scattered throughout the entire measurement route.



Configuration	Measurement Point	Received Field Strength (dBm)	ATSC 3.0 ToV (dB)	5G Broadcast ToV (dB)	Performance Difference (dB)	Average Performance Difference (dB)
#1	#1	-48.28	9.75	11.39	1.64	1.85 (excluding #4)
	#2	-75.26	11.93	13.41	1.48	
	#3	-78.59	11.71	14.15	2.44	
	#4	-86.24	12.18	No Reception	∞	
#2	#1	-48.04	14.57	18.59	4.02	3.67 (excluding #3 & #4)
	#2	-74.80	16.96	20.27	3.31	
	#3	-78.38	15.63	No Reception	∞	
	#4	-86.70	No Reception	No Reception	n/a	

- Result 2: ESR5 Raw data collected from the mobile measurements was processed into an Erroneous Second Ratio 5 (ESR5) curve, representing the received field strength required to guarantee a 95% reception success rate.
  * *ESR5, as defined in ITU-R BT.1368 and BT.2215, represents the ratio of seconds with at least one uncorrectable packet error within a 20-second interval, with a threshold of 5%. ESR is a commonly used metric for evaluating the long-term, average reception performance of terrestrial broadcast systems in mobile environments. By extending the observation interval, a more precise and reliable assessment of the transmission quality can be achieved.*
  - o [Configuration #1] ATSC 3.0: -76.9 dBm, 5G Broadcast: -49.9 dBm, a difference of 27 dB.
    - For 5G Broadcast, reception failures were observed even in open areas with line-of-sight.
  - o [Configuration #2] ATSC 3.0: -72.9 dBm, 5G Broadcast: Mobile reception could not be guaranteed.
    - For 5G Broadcast, reception failures were scattered throughout the tire measurement route.



1.3 OTHER TOPICS ON NEXT GENERATION TERRESTRIAL BROADCASTING

ATSC 3.0, which is a new standard of terrestrial broadcasting developed by the Advanced Television Systems Committee, is promoted for many countries. In the United States, broadcasters are working together to bring ATSC 3.0 to audiences across the country, currently targeting markets that will reach more than 80% of the public. In the Republic of Korea, Ultra High-Definition (UHD) TV broadcasting services using ATSC 3.0 were launched in May 2017, and now reach more than 80% of the South Korean population.

The latest status about ATSC 3.0 and its deployments in various countries are available on the website.

https://www.atsc.org/nextgen-tv/deployments/

In Brazil, preparations are underway for the next-generation digital terrestrial television broadcasting system, called TV 3.0. In 2020, The SBTVD Forum released a Call for Proposals, inviting any interested organizations to submit their candidate technologies for the system components or sub-components. It announced that the studies will be completed by the end of 2024.

https://forumsbtvd.org.br/tv3_0/

Regarding 5G Broadcast, the Republic of Korea conducted experiments as detailed earlier in Section 1.2. Another notable event was a demonstration by Télédiffusion de France (TDF), which delivered linear live TV and radio services over 5G Broadcast in three cities, Paris, Nantes, and Bordeaux, during Paris Olympic Games.

https://www.tvbeurope.com/media-delivery/a-new-era-of-broadcasting-at-the-olympic-games

PROJECT: INTEGRATED BROADCAST-BROADBAND AND OTT (D/IBBOTT)

Project Manager: **Dr Go OHTAKE** (NHK, Japan)
Co-project Manager: **Mr A. K. Mangalgi** (DDI, India)
Mr R.P. Joshi
Dr Hirokazu Kamoda (NHK, Japan)
Mr Hiroki Endo (NHK, Japan)
Mrs Zhang Dingjing (ABS, China)
Zhang Yu (ABS, China)
Zhang Wei (ABS, China)
He Jing (ABS, China)
Wang Lei (ABS, China)

2 STATUS REPORT

This annex describes recent updates on IBB and OTT standards and related technologies identified and studied by this project. It also describes recent update on standards and technologies of information security for broadcasting services and cybersecurity in broadcasting industry for protecting the broadcasting systems.

2.1 STANDARDIZATION OF INTEGRATED BROADCAST-BROADBAND SYSTEM IN JAPAN

IPTV Forum Japan standardizes specifications of Hybridcast in Japan. Technical specification of Hybridcast is composed of two technical standards and an operational guideline listed below and the latest versions are published in January 2022.

- IPTVFJ STD-0010 'Integrated Broadcast-Broadband System Specification', version 2.4
- IPTVFJ STD-0011 'HTML5 Browser Specification', version 2.7
- IPTVFJ STD-0013 'Hybridcast Operational Guideline', version 2.10

In the revision in November 2020 several new features were added to the Hybridcast technical specifications. Major updates are as follows:

- Addition of the new application type named "Broadcast-independent managed application" An application of this type runs in the state that no broadcast channel is being tuned so that service providers can offer application services regardless of their broadcasting area.
- Enhancement to the streaming video playback function The CMAF[*1] is added as a supported container format of streaming video, including low-latency playback features. Support for stream event delivery mechanisms such as an 'event message' (emsg) box and an 'Event' XML element of MPEG DASH[*2] are also added.
- Enhancement to the companion device function UHDTV broadcasting services, i.e. 4K and 8K satellite broadcasting in Japan, are added to the available channels for tuning from a companion device.
- Addition of the three-dimensional audio codec support The enhanced AC-3[*3] is added to the available audio codecs for video streaming.

[*1] ISO/IEC 23000-19 "Multimedia application format (MPEG-A) — Part 19: Common media application format (CMAF) for segmented media".

[*2] ISO/IEC 23009-1 "Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats".

[*3] ETSI TS 102 366 "Digital Audio Compression (AC-3, Enhanced AC-3) Standard".

In the revision in January 2022, several features related to terminated VOD services were deleted from the Hybridcast technical specifications.

2.2 STUDIES IN ITU-R

ITU-R WP6B is working for the study on IBB systems. The working party is now studying on harmonization of IBB systems by making comparison of Hybridcast (Japan), HbbTV2.0 (Europe), TOPSmedia (South Korea) and Ginga (Brazil).

At the meeting held in April 2019 in Geneva, the working party developed the comparison of application life-cycle and application transition of the IBB systems, and revised Report ITU-R BT.2267 "Integrated broadcast-broadband systems" to add a new part on the harmonization of Integrated Broadcast-Broadband (IBB) systems' applications. To allow the exchange of services covered by the IBB systems and to deploy these services in an area where other systems are used, it is important to harmonize the IBB systems, to ensure compatibility with the IBB applications and interoperability across systems.

At the meeting, the working party revised Report ITU-R BT.2342 to replace information on TTML Text and Image Profiles for Internet Media Subtitles and Captions 1.0 (IMSC1.0) with the updated IMSC1.1 and to update a list of current EBU specifications pertinent to the content of the Report.

At the meeting held in July 2019 in Geneva, the working party revised Report BT.2267 to add the companion application to execute the application on a receiver. The working party also developed the new use cases of IBB

system which provides object-based sound services via MPEG-DASH streams.

The working party also developed the global platform. The working party revised Report ITU-R BT.2400 "Usage scenarios, requirements and technical elements of a global platform for the broadcasting service" to add the specific reference to the ATSC 3.0 standard and some examples to show its Internet Protocol-based capabilities to integrate broadcast and broadband services. New digital terrestrial transmission standards such as the ATSC 3.0 system can help effectuate a converged broadcast and broadband platform, which is an important aspect of a global platform for broadcasting services.

At the meeting held in October 2020, the working party revised Recommendation ITU-R BT.2075 "Integrated broadcast-broadband system" to update an application execution mechanism of Hybridcast, with which a companion device sends a command to a receiver to tune to a designated channel and launch a Hybridcast application.

At the meeting held in March 2021, the working party prepared a revised draft report of Recommendation BT.2075 by adding information regarding commonality among IBB systems and equivalency of their functions as described in Report BT.2267 Part 3. The working party also prepared a draft revision to report BT.2267 on IBB systems to align with Recommendation ITU-T J.208 on harmonization of applications between IBB systems.

At the meeting held in September 2022, the working party revised Recommendation ITU-R BT.2075 "Integrated broadcast-broadband system" and Report BT.2267 "Integrated broadcast-broadband systems" to add a Broadcast-independent managed application, which is an application that can be launched when broadcast services are not selected but is still authenticated by broadcasters.

2.3 STUDIES IN ITU-T

ITU-T SG9 is also working for the study on IBB system applied to Cable Digital TV. At the meeting held in November 2018 in Bogota, Colombia, the Study Group started to revise IBB system Recommendation (Recommendation ITU-T J.207 "Specification for integrated broadcast and broadband digital television application control framework") to add the function of device collaboration with companion devices in Hybridcast. Recommendation J.207 is a twin of IBB system Recommendations in ITU; Recommendation ITU-R BT.2075 is another twin on this topic. Therefore, the Study Group continues to revise the Recommendation J.207 in line with the revision of Recommendation ITU-R BT.2075. The Study Group is studying smart TV operating systems for hybrid cable Digital TV services including IBB DTV services provided by cable television operators and third-party providers. At the Bogota meeting, the Study Group made progress the work of the architecture of smart TV operating system. The Study Group consented to the Recommendation of "The functional requirements of smart TV operating system" as Recommendation ITU-T J.1201.

At the meeting held in June 2019 in Geneve, the Study Group consented to Recommendation J.207 to add the function of device collaboration in Hybridcast. The Study Group also made progress the work of drafting new Recommendation "Harmonization of Integrated Broadcast-Broadband DTV application control framework".

As for the smart TV operating system, the Study Group consented to the Recommendation of "The architecture of smart TV operating system" as Recommendation ITU-T J.1202. In addition, the Study Group has begun developing a new Recommendation for the specification of smart TV operating systems.

At the meeting held in November 2023, the Study Group reached the AAP consent for the draft new Recommendation ITU-T J.1206. It has been approved and is now part of the set of already approved Recommendations as follows:

- J.1201: Functional requirements of a smart TV operating system
- J.1202: The architecture of a smart TV operating system
- J.1203: The specification of a smart TV operating system
- J.1204: The security framework of a smart TV operating system
- J.1205: The hardware abstract layer application programming interface of a smart TV operating system
- J.1206: The application programming interface of a smart TV operating system

The group also consented to new Recommendation ITU-T J.208 "Harmonization of Integrated Broadcast-Broadband DTV application control framework" at its November 2020 meeting. The recommendation was created based on Report ITU-R BT.2067 which defined the methods to harmonize IBB systems by identifying commonalities across the IBB systems.

2.4 TOPICS ON CYBERSECURITY

2.4.1 EBU CYBERSECURITY RECOMMENDATION UPDATED

EBU R143 (CYBERSECURITY RECOMMENDATION FOR MEDIA VENDORS' SYSTEMS, SOFTWARE & SERVICES) is a set of guidelines developed by the EBU to assist audiovisual media organizations in safeguarding their digital assets and infrastructure from cyber threats. It was first released in 2016 and has been updated frequently to address the ever-changing challenges and technologies related to cybersecurity.

The most recent update was published in March 2024 to include the cybersecurity requirements of SaaS (Software as a Service). This underscores the evolving landscape of cybersecurity threats and the increasing reliance on cloud-based services within the broadcasting industry. The updated recommendation includes an additional list of cybersecurity requirements for SaaS Products, including strong access management, data protection, security monitoring and incident remediation. EBU recommends

that broadcasters engaged in tenders use it as a basis to set minimal system acceptance levels in their purchasing processes.

Source: https://tech.ebu.ch/publications/r143

2.4.2 RECENT INCIDENTS AT MEDIA ORGANIZATIONS

(a) Television Niigata Network
Television Niigata Network Co., Ltd, in Japan announced on March 13 in 2024 that there was a cyberattack on the internal network of the company.

According to the press release, it was confirmed on March 11 that the data on the internal drives of several terminals and servers connected to the internal network were encrypted and not working properly. Subsequently, an investigation team led by internal system personnel was set up to investigate the damage, and it was determined that this was caused by an external cyberattack. Although no leakage of personal information due to this cyberattack has been confirmed within the scope of the investigation, it has also been confirmed that there was no expansion of the attack from the internal network to the external network. The affected terminals and servers were mainly for information systems and program production, and the cyberattack had no impact on broadcasting.

Source:
https://www.teny.co.jp/info/20240313/20240313_001.pdf

(b) Newfoundland Broadcasting Company
The Newfoundland Broadcasting Company, ltd., owners and operators of NTV and OZFM in Canada, was hit by a cyberattack in May 2024.

The company says the attack has not hampered on-air operations at NTV nor at its radio station, OZFM. A company statement says it has confirmed that the perpetrators accessed parts of its systems and were threatening to post data belonging to the company online.

The Play ransomware group claimed responsibility for the attack, and its site on the dark web says it stole private data including budget and payroll information and client documents from NTV. The group's frequently asked questions page says that it typically encrypts data belonging to its victims so they can no longer access it, and that it will only release it and delete its copies of the stolen information if it receives a payment.

Source:
https://ntv.ca/newfoundland-broadcasting-co-victim-of-cyberattack/ https://www.cbc.ca/news/canada/newfoundland-labrador/ntv-cyberattack-1.7220261

(c) KADOKAWA
KADOKAWA, a major publishing company in Japan, announced that it had confirmed that a cyberattack in June 2024 leaked the personal information of approximately 250,000 people, including business partners and employees of its subsidiary. The servers at the data center of a group company of KADOKAWA suffered a system failure due to a cyberattack by ransomware, a computer virus that demands a ransom payment.

The cause of this incident is still unknown, but it is assumed that employee account information was stolen through "phishing" and other methods, and the internal network was infiltrated.

KADOKAWA's video-sharing site, "Niconico," that had been unavailable due to the cyberattack, resumed service for the first time in approximately two months on August 5. According to Dwango, the site's operator, a new system was built, and security measures were strengthened in order to resume the service. As of August 5, KADOKAWA was also working on the restoration of its publishing business system and expected to be able to publish almost the same number of copies as usual from mid-August onward.

Source:
https://www.kadokawa.co.jp/topics/12088/
https://www3.nhk.or.jp/news/html/20240805/k10014537911000.html

PROJECT: SATELLITE BROADCASTING (D/SB)

Project Manager: **Mr. Masashi KAMEI** (NHK, Japan)
Co-project Manager: **TBD**

3 OBJECTIVES

This annex describes technologies on the latest satellite systems for UHDTV broadcasting and specifications of the latest satellite broadcasting systems. It also describes the latest topics on advanced satellite broadcasting technologies using Ka-band, etc.

3.1 ITU-R DOCUMENTS RELATED TO SATELLITE BROADCASTING SYSTEMS

3.1.1 RADIO REGULATIONS

ARTICLE 23 Section 2 "Broadcasting-satellite services"
APPENDIX 30 "Provisions for all services and associated Plans and List for the broadcasting-satellite service in the frequency bands 11.7-12.2 GHz (in Region 3), 11.7-12.5GHz (in Region 1) and 12.2-12.7 GHz (in Region 2)
APPENDIX 30A "Provisions and associated Plans and List for feeder links for the broadcasting-satellite service (11.7-12.5GHz in Region 1, 12.2-12.7 GHz in Region 2 and 11.7-12.2 GHz in Region 3) in the frequency bands 14.5-14.8 GHz and 17.3-18.1 GHz in Regions 1 and 3, and 17.3-17.8 GHz in Region 2
RESOLUTION 506 "Use by space stations in the broadcasting-satellite service operating in the 12 GHz frequency bands allocated to the broadcasting-satellite service of the geostationary-satellite orbit and no other"
RESOLUTION 507 "Establishment of agreements and associated plans for the broadcasting-satellite service"
RESOLUTION 528 "Introduction of the broadcasting-satellite service (sound) systems and complementary terrestrial broadcasting in the frequency bands allocated to these services within the range 1-3 GHz."
RESOLUTION 536 "Operation of broadcasting satellites serving other countries."
RESOLUTION 548 "Application of the grouping concept in Appendices 30 and 30A in Regions 1 and 3"
RESOLUTION 552 "Long-term access to and development in the frequency band 21.4-22 GHz in Regions 1 and 3"
RESOLUTION 553 "Additional regulatory measures for broadcasting-satellite networks in the frequency band and 21.4-22 GHz in Regions 1 and 3 for the enhancement of equitable access to this frequency band"
RESOLUTION 554 "Application of pfd masks to coordination under No. 9.7 for broadcasting-satellite service networks in the band 21.4-22 GHz in Regions 1 and 3"
RESOLUTION 555 "Additional regulatory provisions for broadcasting-satellite service networks in the frequency band 21.4-22 GHz in Regions 1 and 3 for the enhancement of equitable access to this frequency band"
RESOLUTION 557 "Consideration of possible revision of Annex 7 to Appendix 30 of the Radio Regulations"

3.1.2 RECOMMENDATIONS

(https://www.itu.int/rec/R-REC-BO/en)
BO.1213 "Reference receiving Earth station antenna pattern for the broadcasting-satellite service in the 11.7-12.75 GHz band"
BO.1408 "Transmission system for advanced multimedia services provided by integrated services digital broadcasting in a broadcasting-satellite channel"
BO.1443 "Reference BSS earth station antenna patterns for use in interference assessment involving non-GSO satellites in frequency bands covered by RR Appendix 30"
BO.1516 "Digital multiprogramme television systems for use by satellites operating in the 11/12 GHz frequency range"
BO.1659 "Mitigation techniques for rain attenuation for broadcasting-satellite service systems in frequency bands between 17.3 GHz and 42.5 GHz"
BO.1696 "Methodologies for determining the availability performance for digital multi-programme BSS systems, and their associated feeder links operating in the planned bands"
BO.1724 "Interactive satellite broadcasting systems (television, sound and data)"
BO.1774 "Use of satellite and terrestrial broadcast infrastructures for public warning, disaster mitigation and relief"
BO.1784 "Digital satellite broadcasting system with flexible configuration (television, sound and data)"
BO.1900 "Reference receive earth station antenna pattern for the broadcasting-satellite service in the band 21.4-22 GHz in Regions 1 and 3"
BO.2063 "Alternative BSS earth station antenna radiation pattern for 12 GHz BSS bands with effective apertures in the range 55-75 cm"
BO.2098 "Transmission system for UHDTV satellite broadcasting"

3.1.3 REPORTS

(https://www.itu.int/pub/R-REP-BO/en)
BO.2007 "Considerations for the introduction of broadcasting-satellite service of high-definition television and ultra-high-definition television systems in the band 21.4-22 GHz"
BO.2071 "Broadcasting-satellite service system parameters between 17.3 GHz and 42.5 GHz and associated feeder links"
BO.2101 "Digital satellite broadcasting system (television, sound and data) with flexible configuration"
BO.2102 "Multiple-feed BSS receiving antennas"
BO.2397 "Satellite transmission for UHDTV satellite

broadcasting"

BO.2497 "Characteristics and effectiveness of frequency sharing criteria for the broadcasting-satellite service in Regions 1 and 3 subject to RR Appendix 30"

3.2 LATEST TOPICS ON SATELLITE BROADCASTING

3.2.1 DEVELOPMENT OF LAYERED DIVISION MULTIPLEX TRANSMISSION FOR SATELLITE BROADCASTING

NHK STRL is developing a satellite broadcasting system with layered division multiplex (LDM) that multiplexes multiple modulation signals in the same channel with different power levels with the aim of providing services with flexibility in accordance with changes in the receiving environment due to rain attenuation, etc. as a next-generation satellite broadcasting system. The LDM transmission consists of an upper layer (UL) with high power and a lower layer (LL) with low power, and it enables signals to be transmitted with different bitrates and robustness in the same channel. It is useful for broadcasters to maintain broadcasting services provided by UL signal with a robust transmission parameter during heavy rainfall.

NHK STRL has developed an LDM-based modulator and demodulator for satellite broadcasting in the 21-GHz band. The 21-GHz-band satellite broadcasting allocated to the frequency band of 21.4–22.0 GHz in ITU-R Regions 1 and 3 is expected to be utilized as transmission channels for new broadcasting services with large capacity. Then, two 300-MHz-class wideband transponders are assumed in the 21-GHz band and a wideband LDM-based modulator and demodulator with the nominal symbol rate of 250 Mbaud were developed shown in ***Figure 4-1***.

Versatile Video Coding (VVC), the latest standard in video coding technology, enables multi-layer coding for efficiently encoding multiple videos. It can encode low-resolution and high-resolution videos together, with the former as a base layer (BL) and the latter as an enhancement layer (EL). This enables spatial scalability, i.e., low-resolution image decoding by partial reception and high-resolution video decoding by full reception. Using this function to decode the required part of the bitstream makes it possible to display at a resolution suitable for each receiver. When considering 8K resolution video coding, it can obtain the BL that includes information for 4K resolution and the EL that includes information for 8K resolution based on the prediction with BL.

An advanced satellite broadcasting system in which the BL with 4K resolution and EL with 8K resolution in multi-layer coding of VVC are assigned to the UL and LL of the LDM transmission, is effective as a countermeasure for degradation of receiving condition due to rainfall as explained in ***Figure 4-2***. Programs with 8K resolution are normally shown by receiving both the UL and LL correctly,

Figure 4-1 *Wideband LDM-based modulator and demodulator*

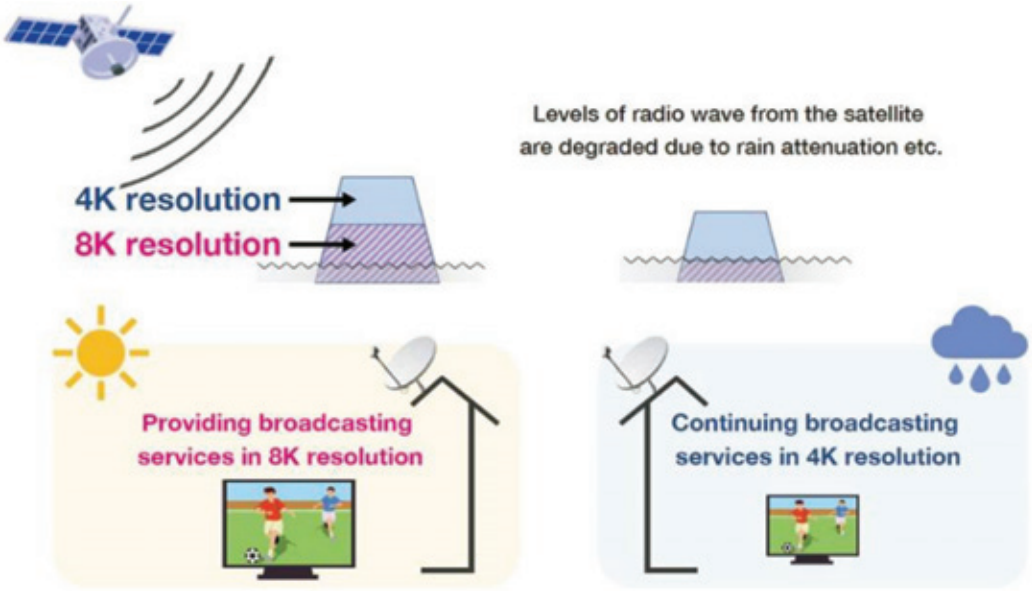


Figure 4-2 *Image of advanced satellite broadcasting system for 8K program with LDM transmission and multi-layer coding of VVC*

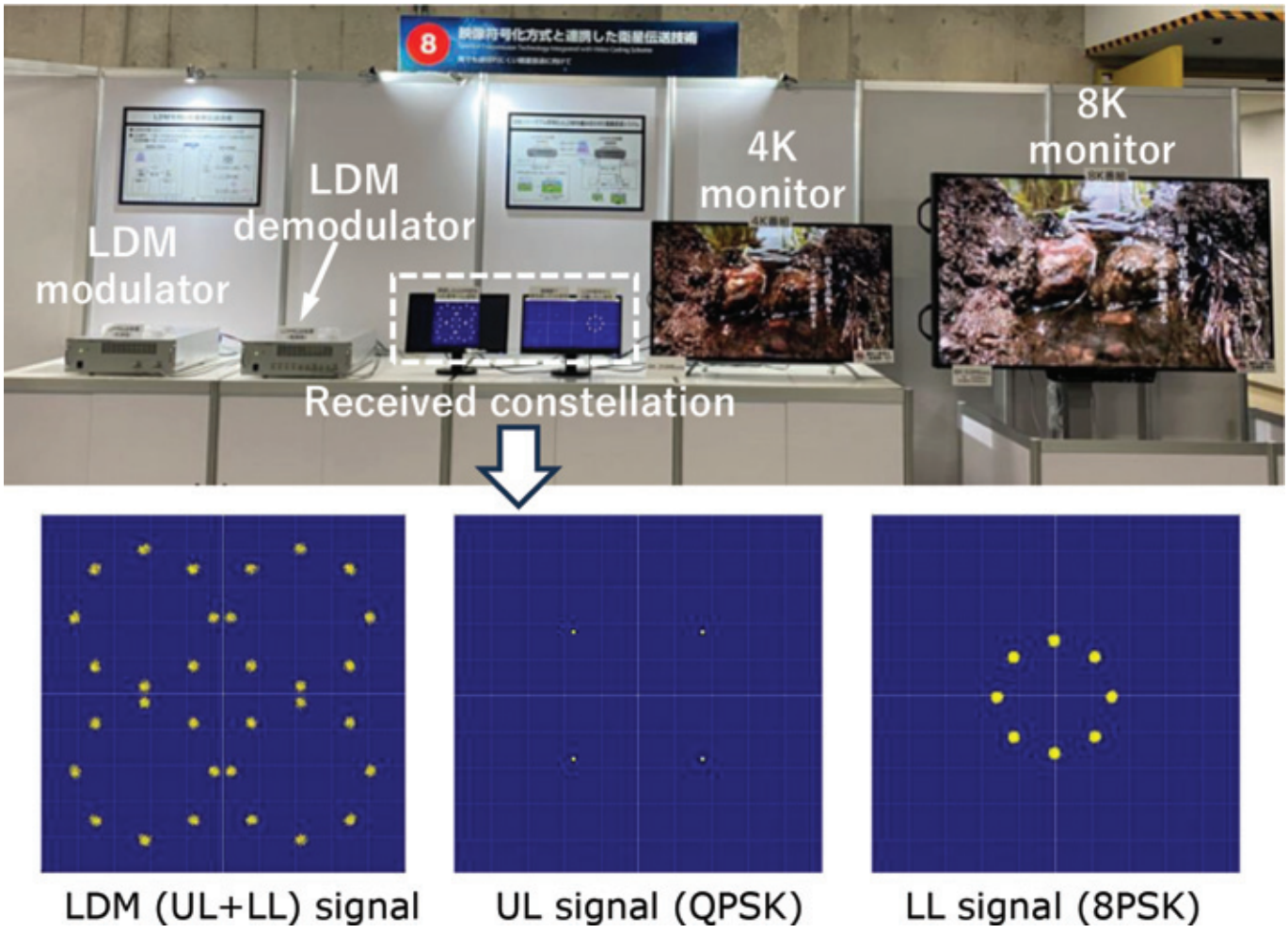


Figure 4-3 *Indoor demonstration at NHK STRL Open House 2024*

while programs with 4K resolutions can be shownduring heavy rainfall by correctly receiving only the UL.

NHK STRL examined its indoor demonstration at NHK STRL Open House 2024 shown in ***Figure 4-3***. The modulation scheme of the UL and LL signals were set to QPSK and 8PSK, respectively. ■

REPORT OF TOPIC CHAIRMAN
TOPIC AREA: PRODUCTION

Topic Chairman: **Kazim PEKTAS (TRT-Türkiye)**
Period of Report: **April 2024 to October 2024**
Date of Report : **20 October, 2024**

Reports from Project Managers in Topic on Production

A total of four projects are under the Production Topic Area, as below.

1. **Ultra High Definition TV and Advanced Immersive Sensory Media Systems P/UHDAISM**
2. **Systems for people with special needs P/SN**
3. **IT -based Production System and file-based workflows P/ITPS**
4. **Big Data, Personalisation and Artificial Intelligence P/BDAI**

For this reporting period we received one contribution from **Mr Tomiyama**, Project Manager of **Ultra High Definition TV and Advanced Immersive Sensory Media Systems P/UHDAISM** from NHK STRL.

ULTRA HIGH DEFINITION TV AND ADVANCED IMMERSIVE SENSORY MEDIA SYSTEMS (P/UHDAISM)

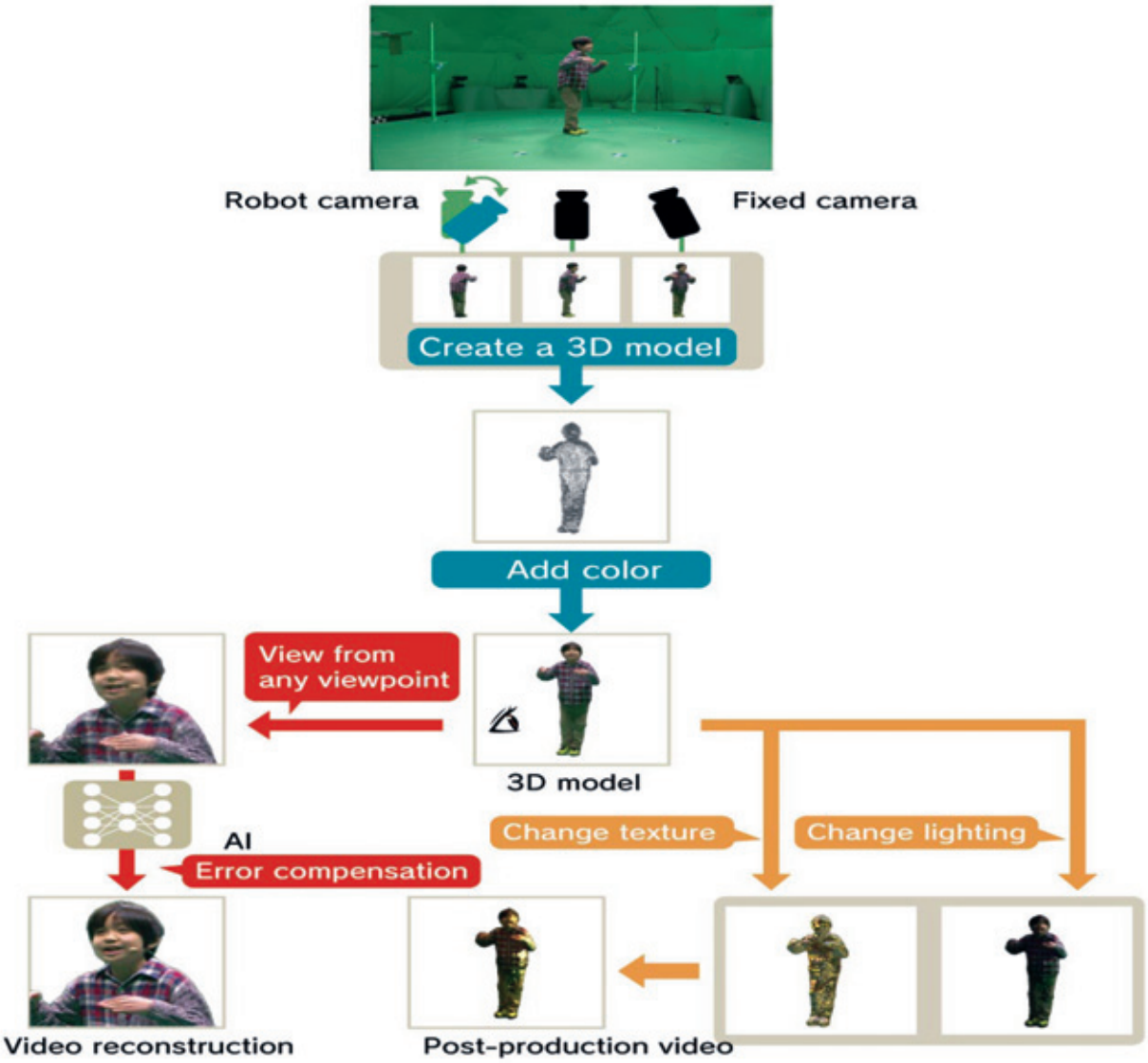


Figure 1 *How does the Meta Studio work?*

1. VOLUMETRIC DATA ACQUISITION BY META STUDIO

To have the viewers watch contents from arbitrary viewpoints on various displays including 3D and/or head-mounted displays, NHK STRL is making studies on acquiring/rendering 3D models of subjects.

The depth of the subject from multiple viewpoints are estimated using the subject's silhouette in the images.

By integrating the depths, the system reconstructs the 3D model which can be viewed from any viewpoint. The consequent errors and defects were compensated by the AI.

Various visual effects can be applied to the created 3D model, such as lighting variations and properties of reflection, resulting in a high-quality, heterogeneous footage that can be viewed from any viewpoint. For example, the model was moved to an outdoor setting and blended with an evening scenic backdrop.

2. VOLUMETRIC VIDEO PRODUCTION SUPPORT SYSTEM

The development of Meta Studio, which produces photorealistic volumetric videos using multi-viewpoint cameras to acquire the 3D shape and reflection properties of the subject, is conducted. Here is the introduction of volumetric monitors and a technology that renders videos in real time.

- Volumetric monitor that presents visual information to support the performers

  For easier cooperation of performers in different place or time, a send-back monitor has been developed. It displays co-performers' images in real time, while switching the viewpoint of the images based on the pose information of the (co-)performers appropriately.

- Interactive display of volumetric videos by real-time rendering processing

  A high-speed processing technology that renders a variety of information, such as shapes and reflection properties, in real time has been developed so that it is possible to render and display images depending on virtual viewpoints on a variety of devices. ■

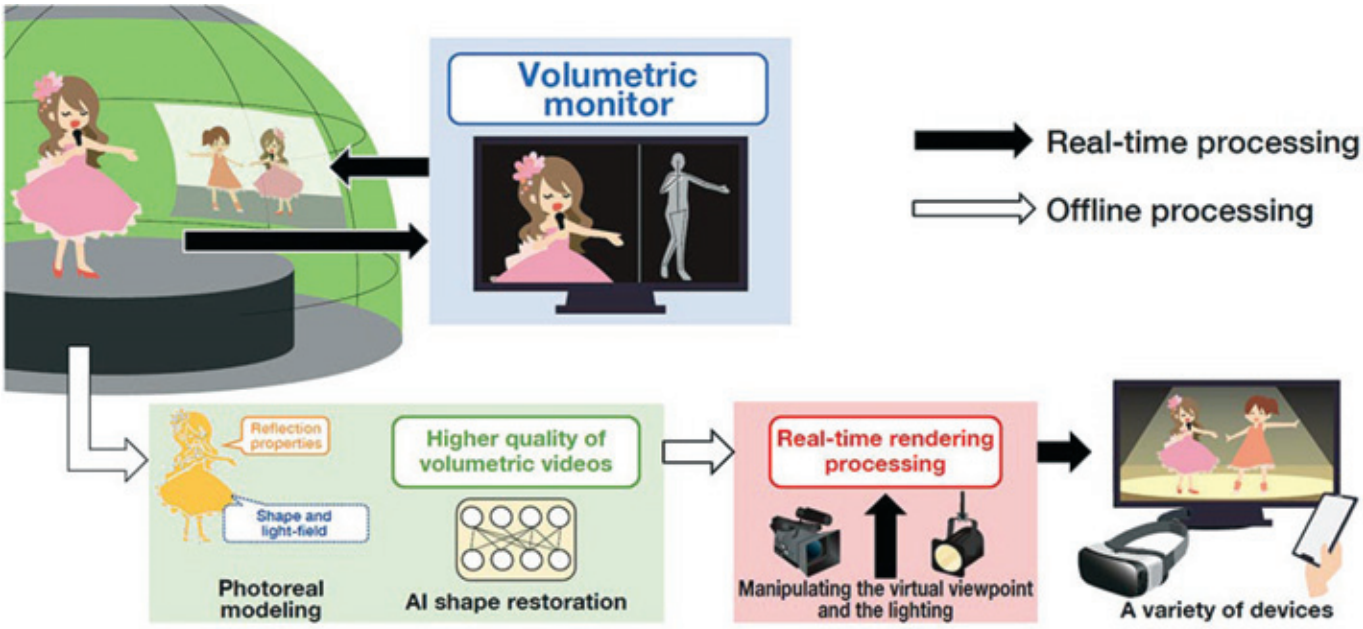
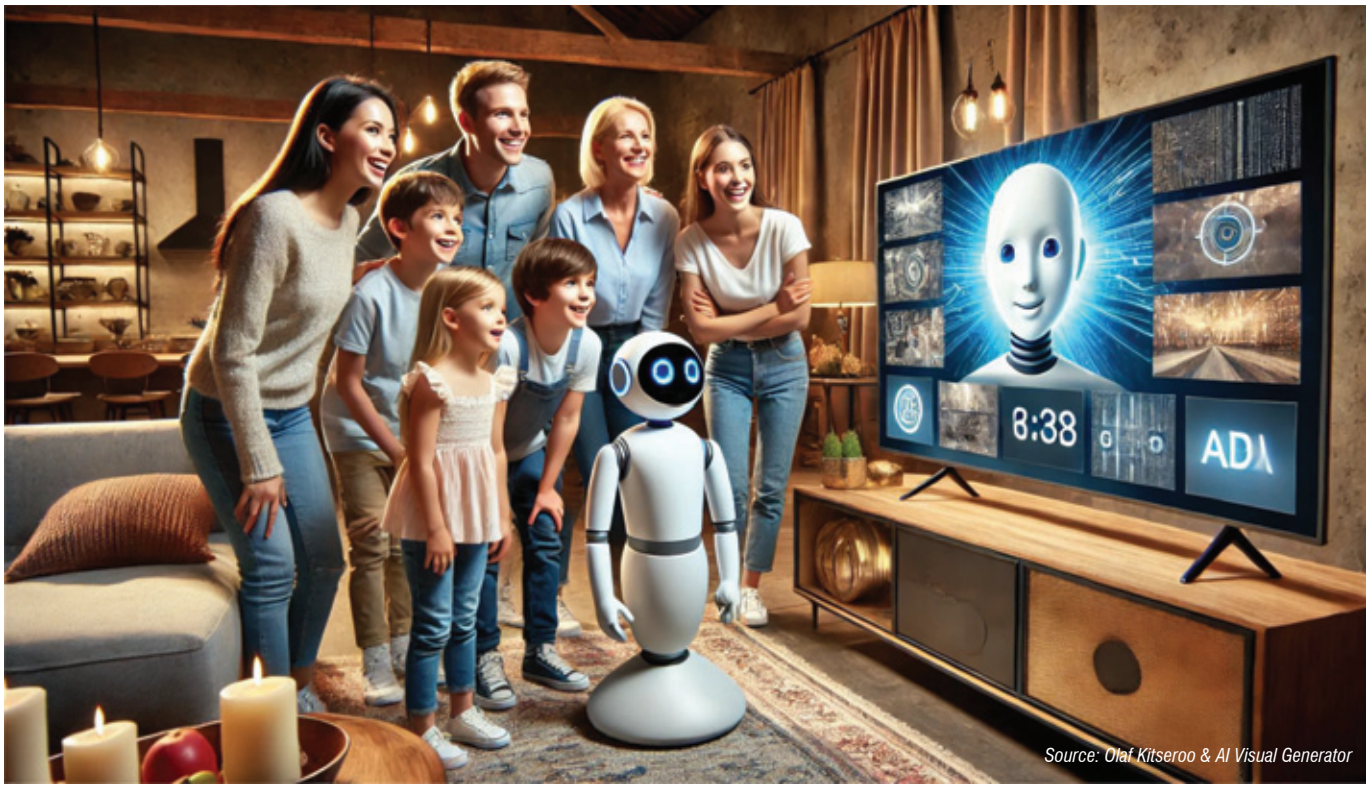


Figure 2 *Volumetric video production system, Meta Studio*

THE FUTURE OF TELEVISION: INTEGRATING AI, WEB3.0, AND SMART TECHNOLOGY INTO A SEAMLESS VIEWING EXPERIENCE



Source: Olaf Kitseroo & AI Visual Generator

The television industry is undergoing a radical transformation, driven by advancements in artificial intelligence (AI), Web3.0 technologies, and the growing integration of smart devices like Google Home. This evolution is reshaping how TV viewers interact with content, how networks and producers distribute programming, and how new technologies like USG (User-Generated Content) and iOTT (Interactive Over-the-Top) services are redefining the entertainment landscape.

The integration of AI distribution, Web3.0 Swiss ID sessions, and smart device compatibility is also enabling a seamless experience across Digital Media Rooms, Broadcast Channels, and Virtual Venues.

TV VIEWERS: EMPOWERED BY PERSONALIZATION

Television viewers are no longer passive consumers. AI-driven personalization algorithms now ensure tailored recommendations based on viewing history, preferences, and even real-time mood analysis. With over **600 million Google Home devices** worldwide, viewers can use voice commands to search, play, or interact with their favorite shows and live events. Smart TV and iOTT platforms elevate the experience by enabling viewers to participate in polls, choose alternate storylines, or engage with interactive advertisements.

In addition, **Web3.0 Swiss ID sessions** offer a secure and decentralized way for viewers to authenticate and manage their digital identities. This technology ensures privacy while allowing personalized access to content, rewards programs,


Source: Ahmad Moradi & AI Visual Generator

Moreover, smart technology integration, including **Google Home** devices and IoT-enabled production tools, streamline workflows. Virtual production environments equipped with AI-driven tools can automatically render VFX, optimize lighting setups, and even generate real-time scripts based on storyline inputs. These innovations not only save time but also reduce costs while maintaining production quality.

WEB3.0 SWISS ID: TRANSFORMING CONTENT INTERACTION

The integration of **Web3.0 Swiss ID sessions** is revolutionizing how viewers interact with content. This decentralized identity solution provides secure, single-login access to multiple platforms, eliminating the need for separate accounts for IPTV, OTT, and iOTT services. It also enables micropayments and token-based rewards for interacting with content, such as answering trivia questions during a live show or voting on plot outcomes.

and interactive features across platforms. Whether watching CCTV/IPTV streaming or OTT services, viewers can seamlessly transition between devices and channels without repeated logins or data concerns.

TV NETWORKS: THE SHIFT TO AI-DRIVEN DISTRIBUTION

TV networks are harnessing the power of **AI distribution** to optimize how content reaches audiences. AI tools analyze viewing patterns, regional preferences, and market trends to deliver content efficiently and effectively. For example, AI can determine the best time slots, platforms, and regions for launching new shows or broadcasting live events.

The rise of **iOTT (Interactive OTT)** services adds another layer to this transformation. Unlike traditional OTT platforms, iOTT enables real-time audience engagement, allowing networks to integrate features like live voting, social media sharing, and interactive advertisements. Networks can leverage Digital Media Rooms to create virtual spaces for premieres, fan engagement, and exclusive behind-the-scenes content.

TV PRODUCERS: EMBRACING USG AND SMART TECHNOLOGY

For producers, the integration of **User-Generated Content (USG)** into mainstream programming is a game-changer. Platforms powered by AI can curate and validate USG content, ensuring high-quality material that aligns with production standards. This democratization of content allows producers to tap into diverse perspectives, creating shows that resonate with wider audiences.

For content producers and networks, Web3.0 opens opportunities for monetization through NFTs (Non-Fungible Tokens) linked to exclusive content, virtual experiences, or memorabilia. A viewer might purchase an NFT to unlock a virtual backstage tour of a live event hosted in a Digital Media Room.

DIGITAL MEDIA ROOMS, BROADCAST CHANNELS, AND VIRTUAL VENUES

The convergence of AI, Web3.0, and smart devices is paving the way for **Digital Media Rooms**, **Broadcast Channels** and **Virtual Venues** as core components of the modern TV ecosystem.

1. **Digital Media Rooms:** These interactive spaces allow viewers to engage with content in real time, whether it's participating in live Q&A sessions with actors or joining virtual watch parties. AI-powered features enhance personalization, while Web3.0 Swiss IDs ensure secure interactions.

2. **Broadcast Channels:** Traditional channels are evolving to include AI-driven scheduling and content recommendations. Networks can integrate iOTT features, enabling real-time audience interaction during live broadcasts.

3. **Virtual Venues:** As the metaverse gains traction, virtual venues are becoming the go-to platforms for live events, from sports to concerts. These venues combine CCTV/IPTV streaming with interactive features, allowing attendees to choose camera angles, participate in chats, or even "teleport" to different sections of the venue.

CCTV, IPTV, OTT, AND IOTT INTEGRATION

The seamless integration of **CCTV and IPTV streaming** with OTT and iOTT platforms creates a unified viewing experience. For example, a viewer can start watching a live CCTV broadcast of a sports event on their smart TV, switch to an interactive iOTT platform for commentary and highlights, and then continue the experience in a Virtual Venue for post-match discussions.

This interconnected ecosystem is powered by AI distribution networks and Web3.0 technologies, ensuring smooth transitions and personalized interactions across platforms and devices.

Source: Ahmad Moradi & AI Visual Generator

CONCLUSION

The future of television is a blend of **AI-powered personalization**, **Web3.0 secure interactions** and **smart technology integration**. From TV viewers to producers and networks, every stakeholder benefit from this transformation. As Digital Media Rooms, Broadcast Channels, and Virtual Venues become new norms, the lines between traditional TV and interactive media continue to blur. With Google Home's vast reach, CCTV/IPTV streaming, and iOTT as a service, the possibilities for immersive and engaging TV experiences are limitless. This AI TV revolution is not just about watching TV; it's about living it.

AUTHOR

DR AHMAD MORADI
CEO - NETSTAIRS & METAXCHANGE.AI and CSO - VYPA

Ahmad Moradi is a seasoned ICT entrepreneur with over 45 years of experience. With a background in mathematics, science, engineering, and international business, he pursued PhD studies in the 1980s, specializing in "Symbolic AI". Moradi introduced the first AI-driven, rule-based multi-specialty practice management software, Office 4te. As a "Knowledge Engineer", he has pioneered numerous innovations, earning 36+ inductions into Who's Who in the U.S. and globally, as well as receiving U.S. Presidential Gold Medals and the Marquis Who's Who Lifetime Achievement Award for leadership.

Moradi has held executive roles in 22 publicly traded companies, driving advancements in Health IT, teleradiology, telemedicine, international banking, and AI-powered media streaming. His achievements include launching the U.S.'s first HMO, introducing groundbreaking technologies in digital advertising and real-time AI streaming, and operating investment banking ventures in Europe and Southeast Asia.

Currently, Moradi serves as CEO of NETSTAIRS and MAXWELL RAND while continuing his work as Chairman and Chief Science Officer (CSO) for select portfolio companies. He has been instrumental in securing patents and innovations in healthcare, media, and AI. ■

CLOUD SERVICES AND REMOTE TOOLS FOR BROADCASTERS WORKSHOP

26-28 NOV 2024

The ABU Technology Department and the Institut Penyiaran dan Penerangan Tun Abdul Razak (IPPTAR) jointly organized the Workshop on Cloud Services and Remote Tools for Broadcasters, which was held from 26-28 November 2024 at Cendekiawan Hall, Angkasapuri, Kuala Lumpur.

The workshop began with a warm welcome address by **Ms Sumathy Vaidappan**, Head of the Creative Industry at IPPTAR, followed by opening remarks from **Dr Veysel Binbay**, Director of Technology & Innovation at ABU. The event aimed to familiarize broadcasters with emerging technological advancements, particularly in cloud services.

The workshop attracted over 75 participants, including representatives from RTM, government agencies, ABU members, and several international delegates. Esteemed speakers from leading solution providers across the region, such as Harmonic, Skyline, IPSB, Benchmark, TVU, and RTM, shared their insights, making the event an invaluable platform for knowledge exchange and networking.

The first session was well delivered by **Desmond Kee** from Harmonic Inc. with his presentation on the Harmonic VOS360 Cloud SaaS Introduction. Also present was **Steve Lee**, who provided a thorough explanation of Harmonic Playout. The VOS360 Cloud SaaS is an advanced playout and video platform service for broadcasters and content providers. It provides an end-to-end video pipeline that covers content ingestion, processing, and delivery.

The platform supports both live and file-based content ingestion, utilizing secure protocols like SRT for high-quality, low-latency streaming. Video content is processed through encoding, transcoding, and packaging, with support for multiple codecs, including H.264, HEVC, and formats like MPEG-2, XDCAM, and AVC. Delivery is enabled through adaptive bitrate (ABR) streaming protocols such as HLS and DASH, allowing for direct-to-consumer or affiliate distribution.

The playout capabilities of VOS360 are highly advanced, offering dynamic graphics and branding features through multi-layer HTML5-based graphics. This allows for real-time updates and interactive elements such as news tickers and social media feeds. Playlist management is flexible, supporting manual creation via the VOS Playlist App or automation through integration with external traffic systems. The platform also includes a loop record and playback feature, enabling broadcasters to record live segments and replay them, which is particularly useful for events like sports or news broadcasts.

VOS360 ensures high availability and reliability with its active-active redundancy across multiple availability zones. This setup provides geo-redundancy, ensuring continuous service even during failures, with an impressive uptime of over 99.9999%. Security is another strong point, as the platform integrates with various Digital Rights Management (DRM) systems and supports SCTE-35 markers for ad insertion and content blackout.

The platform is highly flexible, supporting a wide range of broadcast and OTT formats, including MXF, MPEG-2, XDCAM, HLS, and DASH. It handles resolutions from SD and HD to UHD/4K with HDR compatibility. Additionally, the robust graphics engine allows broadcasters to create and manage graphics templates via a web interface, supporting up to 8 layers for complex branding needs without pre-rendering.

Harmonic VOS360 also excels in monetization through its Server-Side Ad Insertion (SSAI), enabling dynamic ad replacement tailored to specific audiences. Ad placement is automated using SCTE-35 markers, enhancing revenue opportunities. The platform's use cases include linear TV streaming, Free Ad-Supported Streaming TV (FAST) channels, pop-up channels for special events, and hybrid deployments combining on-premises and cloud workflows.

A demonstration was performed by **Viky Subramaniam** to showcase the User Interface (UI) of the VOS360 platform with its functionality. In his demonstration, he focused on several key items, such as creating a playout service in VOS, an overview of playout, and playout with SSAI ads and content replacement.

He also highlighted case studies, such as the hybrid channel origination model employed by Swiss broadcasters RTS and RSI, which combines on-premises and cloud-based workflows. Another case study demonstrated the platform's capability in live OTT streaming for sports events, ensuring global distribution of high-quality content. VOS360's automation-driven workflows are particularly effective for network and FAST channels, facilitating efficient delivery of both linear and on-demand content.

Next, participants were introduced to the DataMiner platform by **Naveendran Murthy** from Skyline Communications. DataMiner is a comprehensive solution for managing complex, mission-critical, data-driven ecosystems. Supporting over 9,000 product integrations from more than 1,000 technology vendors, the

platform demonstrates exceptional versatility across diverse industries.

DataMiner's architecture is built on a modular and vendor-agnostic framework, enabling seamless integration with a wide range of technologies. At its core lies the Data Aggregation Engine, which facilitates the ingestion of both structured and unstructured data from various sources. These include widely used protocols such as SNMP, SOAP, REST, JSON, XML, and OpenConfig, as well as interfaces like Telnet, SSH, SQL, and HTTP/HTTPS. The platform's protocol integration...

DataMiner includes a comprehensive suite of visualization tools. MS Visio-based visuals allow users to create interactive, real-time graphical representations of their operations. Custom dashboards, built using a drag-and-drop interface, facilitate real-time KPI monitoring and data aggregation, while event and fault correlation consolidate information from multiple sources into unified incident views. Additionally, ChatOps integration enables collaborative incident management, enhancing response times and decision-making processes.

DataMiner's architecture incorporates robust security features, including role-based access control (RBAC) for secure access to sensitive data and controls. Its design supports high availability and redundancy with active-active clustering and geo-redundancy, ensuring over 99.999% uptime. Data protection is also a priority, with built-in encryption and secure API integrations safeguarding data integrity across the ecosystem.

Overall, Skyline DataMiner is an advanced platform tailored to the demands of modern ICT and media operations. Its modular, vendor-agnostic design, coupled with powerful AI-driven automation and orchestration, delivers unmatched flexibility and scalability. With real-time operational insights, robust security, and seamless integration capabilities, DataMiner empowers organizations to optimize performance and foster innovation in complex, dynamic environments.

The workshop continues on the second day with a presentation by **Mardhiah Nasir**, Executive Director of IPSB Technology, titled "AWS Empowering Broadcasters with Cloud Technologies". The presentation highlights the advancements and benefits that AWS brings to the media and entertainment industry through its cloud-based solutions. It emphasizes AWS's commitment to innovation, sustainability, and support for broadcasters by providing scalable, secure, and cost-effective technologies tailored to industry needs.

AWS has been actively investing in Malaysia since 2016, with plans to launch the AWS Malaysia Region in 2025. These investments are projected to contribute MYR 57.3 billion to Malaysia's GDP over 14 years, support an average of 3,500 full-time jobs annually, and drive significant economic impact. AWS Regions are designed to ensure high availability, scalability, and fault tolerance while maintaining data residency within Malaysia unless otherwise specified.

For broadcasters, AWS offers transformative solutions such as cloud-based live production, which provides real-time broadcasting capabilities while reducing costs, requiring minimal on-premises infrastructure, and promoting eco-friendly practices. This is particularly beneficial for live events such as sports broadcasts and news coverage, allowing for flexibility, scalability, and remote collaboration. The presentation also identifies key trends in the M&E industry, including cost optimization, scalability, sustainable workflows, and fostering innovation through experimentation. Transitioning from CapEx to OpEx models allows broadcasters to scale resources flexibly, reducing initial infrastructure costs while enabling innovative experimentation.

Technologies like AWS Direct Connect enable broadcasters to benefit from low latency and high data security, making them well-suited for the industry's real-time needs. A case study of live production workload overview shows that by transitioning from traditional on-site models to cloud-based solutions, broadcasters can achieve greater efficiency, scalability, and flexibility. Traditionally, live production relies heavily on on-site infrastructure, including outside broadcast (OB) vans, extensive production control rooms, and large teams of personnel. Essential components such as vision mixers, audio mixers, replay servers, graphics systems, and camera controls are all managed on-site, with additional core systems like AV routers, sync generators, and playout systems ensuring synchronized transmission. While effective, this traditional model is costly, rigid, and resource-intensive, requiring personnel to be physically present and often leading to inefficiencies through resource overprovisioning.

AWS's cloud-based live production revolutionizes this model by introducing scalable, cost-effective, and flexible solutions. Unlike traditional setups, cloud production enables broadcasters to scale resources based on event size and audience demand, minimizing overprovisioning and operational costs. AWS's remote collaboration tools allow production teams to work seamlessly from different locations, eliminating the need for on-site personnel and enabling global teamwork. Additionally, transitioning to a cloud-based infrastructure reduces reliance on physical hardware, promoting eco-friendly practices and aligning with AWS's sustainability initiatives.

Next, she also addresses the challenges of managing and protecting data in the cloud. Through its Shared Responsibility Model, AWS ensures robust security for customer data, offering encryption, access control, and compliance with global standards. This model is crucial for maintaining data safety while leveraging the advantages of cloud technology.

In the afternoon session, the participants delved into the topic of "Hybrid Playout – Opportunities and Challenges in Implementation", presented by **Venkatesh Kalidasan**, Senior Solutions Architect at Benchmark Broadcast Systems.

The workshop provided an in-depth exploration of the evolving broadcasting landscape, highlighting how hybrid playout solutions bridge traditional on-premises systems with modern cloud technologies.

Hybrid playout is a broadcasting solution that integrates traditional broadcast technologies with IP-based systems, allowing for the convergence of on-premises and cloud infrastructure. This approach offers broadcasters the ability to streamline and enhance content distribution workflows while gradually transitioning to cloud technologies at a pace that aligns with their operational needs.

Hybrid playout systems combine the robust reliability of on-premises workflows with the dynamic scalability of cloud technologies. These systems manage both uncompressed and compressed signal formats, including SDI, IP (ST 2110), and file-based workflows like XAVC, ProRes, and MP4. The hybrid architecture ensures seamless operation by integrating automation systems, centralized control mechanisms, and failover redundancies. This architecture is particularly relevant for broadcasters transitioning from legacy systems to cloud-based platforms, as it bridges the gap without requiring a complete infrastructure overhaul.

A hybrid workflow allows broadcasters to maintain operational continuity while integrating advanced capabilities for OTT streaming, pop-up channels, and next-generation platforms. For example, primary 24/7 channels can run on-premises, while disaster recovery (DR) or ad-hoc event workflows are managed in the cloud. This flexibility ensures resilience by leveraging fallback systems during outages or peak demand. Additionally, the architecture supports web-based channel control, enabling operators to synchronize cloud and on-prem workflows effectively.

From a technical perspective, hybrid playout solutions offer significant benefits, including low-latency real-time streaming through protocols such as RTMP, HLS, and SRT. Integrated automation systems streamline playout management, covering aspects like ingest, graphics rendering, subtitling, and audio mixing. The model also incorporates failover mechanisms, ensuring reliability through synchronized cloud and on-prem systems. These technical features allow broadcasters to deploy a unified infrastructure that supports complex workflows, including live feeds and Video-on-Demand (VOD) services across diverse distribution platforms.

Despite its advantages, hybrid playout poses technical challenges. Latency is a critical concern, as data transmission between on-prem and cloud systems can introduce delays, especially in live broadcasting. Compatibility between legacy systems and cloud platforms requires significant effort in data migration, workflow optimization, and API integrations. Synchronizing operations across these systems is another challenge, particularly for real-time broadcasts where timing discrepancies can disrupt continuity. Additionally, ensuring high-quality video streams in cloud environments necessitates advanced error correction and bandwidth management techniques.

Security is a critical layer of hybrid playout architectures. The model mandates robust network security protocols, such as firewalls, SDN, and VPNs, to safeguard connectivity. Role-Based Access Control (RBAC), Multi-Factor Authentication (MFA), and end-to-end data encryption secure sensitive media assets during transit and storage. Automated threat detection, behavioral analytics, and incident response systems provide an additional layer of security, ensuring compliance with industry standards and regulatory frameworks. Backup and disaster recovery mechanisms, such as automated failover and load balancing, further enhance system reliability.

Guidelines for migrating to hybrid playout workflows emphasize five key dimensions: business, technical, security, operational, and vendor readiness. Technical preparation involves ensuring compatibility between existing broadcast infrastructure and cloud platforms, evaluating network bandwidth for real-time streaming, and implementing redundancy measures to mitigate risks. Operational readiness focuses on training personnel, automating workflows, and enabling remote production capabilities. Vendor evaluation requires careful assessment of service-level agreements (SLAs) and the technical expertise of cloud providers.

In conclusion, hybrid playout represents a technically advanced solution for modern broadcasters, enabling them to balance traditional reliability with cloud-driven innovation. By addressing scalability, cost-efficiency, and resilience, these systems position broadcasters to meet the demands of a rapidly evolving industry while navigating the complexities of integrating legacy and cloud workflows. With proper planning and technical expertise, hybrid playout workflows can deliver high-quality, secure, and flexible broadcasting solutions.

On the final day, **Jay Teodoro** presents on TVU Networks' Cloud Production Solutions. TVU Networks has established itself as a leader in providing cutting-edge tools and methodologies for the digital transformation of media businesses. With over 19 years of experience in the Media and Entertainment (M&E) industry, TVU supports more than 4,000 customers globally, enabling the transmission of over 10 million hours of content annually. The company's platform comprises over 140 microservices designed for rapid customization, ensuring seamless integration across live contribution, production, and distribution workflows.

TVU offers a range of advanced technologies that cater to various production needs:

TVU One

TVU One is a portable live video transmitter capable of delivering ultra-low latency (0.3 seconds) video over 5G, LTE, Wi-Fi, or satellite connections. This system supports high-definition (HD) and 4K video, ensuring superior quality even in

challenging network conditions. Its advanced HEVC encoding optimizes bandwidth usage, making it ideal for remote production and live event coverage.

TVU RPS (Remote Production System)

TVU RPS enables synchronized multi-camera live production over standard public internet connections. Using precision timing technology, it achieves frame-accurate synchronization for up to six cameras, drastically reducing the reliance on satellite or fiber infrastructure while lowering costs. The system also supports flexible deployment for complex workflows such as sports broadcasting and large-scale events.

TVU Anywhere

This mobile application transforms any iOS or Android device into a professional live video transmitter. With support for 4K video and bonding multiple network connections, TVU Anywhere ensures reliable transmission for journalists and remote teams. Its integration with TVU's cloud ecosystem allows seamless coordination across production workflows.

TVU Transceiver

TVU Transceiver serves as the backbone for IP-based production workflows, offering encoding, decoding, and distribution capabilities. Its compatibility with various IP protocols ensures smooth integration with third-party systems, enabling broadcasters to centralize content management and distribution.

TVU has also developed a suite of cloud-based tools designed to streamline live production processes. TVU Producer, a cloud-native production platform, offers live switching, multiview monitoring, graphics overlays, and audio mixing, enabling broadcasters to produce complex live shows without the need for on-site equipment. TVU Partyline facilitates real-time collaboration, allowing production teams, remote contributors, and audiences to interact with zero-latency communication. This feature is particularly useful in live broadcasting, where real-time decision-making is crucial.

TVU Remote Commentator supports remote commentary with ultra-low latency, making it ideal for sports events and multilingual broadcasts. TVU Replay, a cloud-based replay system, provides instant access to replays, enhancing sports coverage with high-quality, frame-accurate playback.

Moreover, TVU's cloud-based approach to production and distribution provides significant sustainability benefits. By eliminating the need for on-site hardware and reducing travel requirements, broadcasters can lower their operational costs and reduce their carbon footprint. The use of shared cloud resources also optimizes energy consumption, aligning with eco-friendly broadcasting practices. This shift towards cloud-based workflows not only helps broadcasters stay agile and competitive but also contributes to a more sustainable media industry.

In conclusion, TVU Networks has redefined the broadcasting landscape by offering seamless, cloud-based production solutions that integrate AI-driven automation, low-latency communication, and advanced IP workflows. With its focus on scalability, efficiency, and flexibility, TVU provides broadcasters with the tools they need to thrive in a digital-first world. By adopting TVU's cloud solutions, broadcasters can reduce costs, enhance their content offerings, and improve the overall viewer experience, making TVU a pivotal player in the ongoing transformation of the media industry.

The final session of the workshop was delivered by **Ts. Ir. Ahmad Shafiq Mirza**, focusing on RTM's Pathway to Innovative Modern Broadcasting. He highlighted that Radio Televisyen Malaysia (RTM) has been a pioneer in adopting technological advancements to modernize its broadcasting operations. Through the integration of cloud services, hybrid workflows, and remote production tools, RTM has greatly improved its operational efficiency and content delivery capabilities.

RTM's integration of cloud services has streamlined its end-to-end production processes, enabling seamless content management and distribution. By leveraging cloud platforms, RTM has significantly reduced its dependency on physical infrastructure, achieving cost optimization while maintaining high-quality standards. These platforms provide RTM with unparalleled scalability, allowing it to accommodate peak demands during large-scale live events or high-profile broadcasts. Moreover, the cloud facilitates real-time editing, processing, and scheduling, ensuring faster turnaround times for live broadcasts and pre-recorded content. This flexibility has been particularly instrumental in RTM's ability to respond swiftly to dynamic audience needs.

The implementation of hybrid workflows has further enhanced RTM's transition from traditional to modern broadcasting systems. By integrating legacy equipment with state-of-the-art cloud-based solutions, RTM has established a robust framework that supports multi-platform content delivery. These workflows enable RTM to distribute content seamlessly across television, radio, and digital platforms, catering to diverse audience preferences. Additionally, hybrid workflows optimize the utilization of existing resources, reducing the need for extensive infrastructure upgrades while delivering advanced functionalities such as automated playout and adaptive content scaling.

Remote production tools have emerged as a cornerstone of RTM's modern broadcasting strategy. These tools enable efficient live production by reducing the reliance on on-site personnel and equipment. RTM's adoption of remote collaboration systems ensures real-time coordination among geographically dispersed teams, enhancing the accuracy and speed of production workflows. Remote tools have also bolstered RTM's operational resilience, allowing uninterrupted broadcasting during disruptions such as travel restrictions or limited site access. With capabilities like multi-

camera synchronization and real-time monitoring, RTM has elevated its live event coverage, offering audiences a rich and immersive experience.

RTM's modernization efforts align with its commitment to sustainability and innovation. By reducing travel requirements, optimizing energy consumption, and minimizing the use of physical resources, RTM has significantly lowered its carbon footprint. Furthermore, the integration of emerging technologies, including AI-driven content management and real-time analytics, has positioned RTM as a forward-thinking leader in the broadcasting industry. These innovations enable RTM to deliver personalized and engaging content while continuously refining its operational strategies.

Through its adoption of cloud services, hybrid workflows, and remote tools, RTM has successfully redefined its broadcasting paradigm. The organization's commitment to technical excellence and sustainable practices not only enhances its operational capabilities but also sets a benchmark for modern broadcasting standards. As RTM continues to innovate and adapt, it remains a pivotal example of how traditional broadcasters can leverage advanced technologies to thrive in a competitive and dynamic media environment.

The workshop concluded with closing remarks from Dr. Veysel Binbay, Director of the Technology Department at ABU. He emphasized that the thematic event had provided participants with valuable knowledge, skills, and key takeaways. Dr. Binbay expressed his confidence that the insights gained would empower attendees to advance their efforts in digitizing and preserving content for the future within their respective organizations.

After the closing ceremony, participants had the opportunity to tour the in-house facilities at Wisma Berita and Media Teknologi Aplikasi (MTA). At Wisma Berita, the tour, led by Mr. Shafiq, included briefings on technical operations, focusing on news production workflows, management, and distribution processes. At the MTA division, Ms. Nurul Husna provided an overview of the development, management, and maintenance of RTM's internal campus network and the technical infrastructure supporting MyKlik, RTM's dedicated OTT platform. ■

News from the ABU Region

ABC INTERNATIONAL CELEBRATES 85 YEARS

The Australian Broadcasting Corporation (ABC) marks 85 years as Australia's trusted international voice. Established on 20 December 1939 during the early days of World War II, ABC Radio Australia, originally named Australian Calling, was launched by Prime Minister Robert Menzies to combat enemy disinformation and propaganda. Over the decades, ABC International has evolved to engage audiences across Asia and the Pacific through its teams, ABC International Services and ABC International Development.

Currently, ABC Radio Australia and the international television service ABC Australia reach nearly 11 million people monthly, while digital platforms ABC Pacific and ABC Asia are rapidly expanding. ABC International Development, funded by the Australian Government through DFAT, continues to support media capacity-building initiatives, fostering public interest journalism in the region.

To commemorate its milestone, ABC International has introduced the Indo-Pacific Media Map, an interactive platform showcasing its activities, audiences, and regional impact. Special anniversary content is also featured across ABC Pacific, ABC Asia, and ABC Radio Australia, including interviews with former broadcasters, reflections on key programming moments, and a digital feature exploring ABC International's rich history.

Claire M. Gorman, Head of ABC International, expressed pride in the organization's legacy as a trusted and independent Australian voice in the Asia Pacific. She emphasized a commitment to growing audiences, strengthening connections, and promoting regional storytelling and independent media. [ABC]

RTM LEADS MALAYSIA'S FIRST 5G BROADCAST WITH DNB AND ERICSSON

Malaysia has achieved a remarkable milestone by successfully executing its inaugural 5G-enabled live broadcast during the 2024 National Day parade. This ground-breaking event was made possible through a strategic collaboration involving Radio Televisyen Malaysia (RTM), Digital Nasional Bhd (DNB), and Ericsson.

The live broadcast served as a proof of concept, showcasing essential broadcasting elements such as video, audio, and monitoring, all facilitated by DNB's advanced 5G standalone (5G SA) network. This innovative technology allowed for an unparalleled broadcasting experience, demonstrating the significant advantages of 5G, including increased bandwidth and reduced latency. These enhancements provided camera operators with greater mobility and offered producers enhanced control over the production process, marking a departure from the conventional reliance on cumbersome cables and bulky satellite equipment.

During the event, the broadcast was effectively monitored and adjusted remotely, illustrating the transformative potential of 5G technology in the realm of live transmissions. Ken Tan, DNB's chief technology officer, underscored the importance of 5G network slicing, which guarantees seamless and secure management of broadcast operations. Meanwhile, David Hägerbro, the Head of Ericsson for Malaysia, Sri Lanka, and Bangladesh, pointed out how 5G technology has significantly augmented RTM's broadcasting capabilities, enabling improved real-time streaming and increased operational flexibility. This achievement not only highlights the power of modern telecommunications but also sets a new standard for future broadcasting endeavours. [ABU News]

NEW STANDARD FOR VC-3 CODEC IN IMF

SMPTE and Avid have collaborated to establish a new standard, SMPTE ST 2067-70, integrating the VC-3 codec (marketed by Avid under the DNx brand) into the Interoperable Master Format (IMF). This development aims to streamline audio-visual content distribution by allowing the same mezzanine-quality codec used in production to transition seamlessly into the IMF mastering process.

The VC-3 codec is a widely used production format employed by media organizations for critical tasks such as video capture, editing, rendering, transcoding, and archival. The new standard ensures that VC-3's high-quality performance is preserved through the IMF workflow, enabling broadcasters and content producers to maintain original creative intent during distribution, revisioning, and archiving.

IMF, a key international standard for media distribution, simplifies the creation of multiple content versions for global markets by organizing them into a single master file package. By incorporating VC- 3 into IMF, the ST 2067-70 standard enhances the compatibility of production and distribution workflows, reducing the need for transcoding, which can degrade quality. This also supports the use of constant bit rate (CBR) profiles for predictable storage and network efficiency.

The standard emerged from a collaboration involving SMPTE, Avid, and the DPP, a media industry organization. The DPP's involvement highlighted the practical benefits

of this integration, including faster turnaround times, simplified content changes, and improved workflow efficiency.

Avid executives emphasized the significance of this standard, noting its alignment with customer needs for maintaining high-quality production. [Content+Technology]

ABC AND SBS UPGRADES FM BROADCAST WITH DIELECTRIC'S INNOVATIVE ANTENNA SYSTEM

The Australian Broadcasting Corporation (ABC) and Australia's Special Broadcasting Service (SBS) collaborated with BAI Communications to upgrade an FM broadcast tower in Perth, Western Australia. The project involved the installation of a Dielectric DCR-U ring-style antenna system to address the structural and operational challenges of the aging tower, originally built in the 1960s.

BAI RF Engineering Manager Matt Betts highlighted that evolving structural standard necessitated a reduction in weight and wind load to maintain compliance. The ring-style design was chosen for its suitability on a sloping section of the tower, offering a lighter and more efficient alternative to traditional panel arrays. This innovative approach ensured the tower met current structural requirements while supporting optimal antenna placement.

The new system also addressed the limitations of the previous secondary antenna, which was restricted to horizontal polarization and could not operate at full power. The Dielectric antenna, with its circular polarization, supports up to six 20 kW FM services, enabling full-power operation of transmitters. Its robust construction, streamlined components, and centre-fed design contribute to long-term reliability and reduced risk of failure.

Betts emphasized the future-proof nature of the system, which allows for the addition of new FM services across any channel within the band. This ensures the infrastructure can adapt to future broadcasting needs while maintaining high performance and compliance with updated standards. [RedTech]

A NEW ERA OF MEDIA DIGITIZATION: MALAYSIA EMBARKS ON A JOURNEY TO PROTECT AND MONETIZE AUDIO-VISUAL CONTENT

The DAMsmart Asia Centre of Excellence hosted a landmark event, the "Media Digitization, Restoration, Delivery, Management, and Monetization" seminar, in conjunction with the 33rd Malaysia Film Festival (FFM33). Organized by Dotcom Telecommunications (Malaysia), Silver Trak Digital (Australia), and Ortana Media Group (UK), the seminar aimed to revolutionize the preservation and monetization of audio-visual (AV) archives using AI and cloud technologies, positioning Malaysia as a global leader in AV content management.

A pivotal moment occurred when the three organizations signed a Memorandum of Understanding (MOU) to introduce the world's first end-to-end 'Media Ecosystem' in Malaysia. The event, co-hosted by the National Film Development Corporation of Malaysia (FINAS), featured three key components: the MOU signing, live demonstrations of AI-driven media solutions, and expert workshops on AV archive preservation and marketing strategies.

The initiative highlights the urgency of preserving Malaysia's cultural heritage, particularly as the 2025 deadline approaches for digitizing materials stored on magnetic tape formats, which risk being lost due to degradation and technological obsolescence. Industry leaders emphasized the importance of resource integration, knowledge transfer, and establishing a unified policy to protect national treasures for future generations.

Technologically, the ecosystem employs generative AI solutions to enhance content management, enrichment, and monetization. This, combined with AWS Asia Pacific's cloud infrastructure, positions Malaysia as a leader in AV preservation. Looking forward, the initiative not only aims to preserve cultural heritage but also to drive economic growth, create job opportunities, and foster regional knowledge exchange, solidifying Malaysia's role as a global leader in AV content management. [DAMsmart]

ASTRO ACHIEVES MAJOR GAINS AGAINST CONTENT PIRACY

Content piracy represents more than lost revenue – it undermines opportunities, jobs, and the futures of content creators. Recognizing this, Malaysian subscription operator Astro intensified its efforts against digital piracy in the first half of FY25, achieving significant milestones to safeguard the content ecosystem.

Through legal actions and collaborations with enforcement agencies, Astro recorded a total action value of RM808,927.20 (USD 180,000) against digital piracy. This figure encompasses fines, settlements, and the prosecution of sellers of illegal streaming devices (ISD), alongside gains in legitimate subscriptions.

Astro Group CEO Euan Daryl Smith emphasized that piracy threatens not just business but the very foundation of creativity. He highlighted that every act of piracy impacts the actors, directors, and small businesses behind content production.

Astro's multi-faceted anti-piracy strategy includes partnerships with the Malaysian Communication and Multimedia Commission, the Royal Malaysian Police, and the Ministry of Domestic Trade and Cost of Living. Together, they are dismantling piracy networks, shutting down illegal broadcasts, and prosecuting those who profit from piracy.

In addition to enforcement, Astro prioritizes consumer education. The company warns that illegal streaming platforms pose significant cybersecurity risks, including malware, ransomware, and phishing schemes. Euan stressed that choosing legal platforms supports the creative ecosystem, ensures fair compensation for creators, and offers worry-free content for audiences.

To highlight its efforts, Astro released a mid-year report

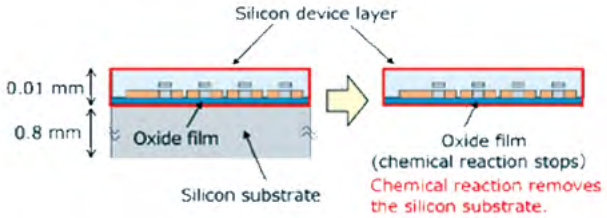
detailing its anti-piracy achievements, the partnerships driving these results, and the dangers of illegal streaming. The company views these early victories as a starting point in its ongoing fight against piracy, aiming to build a future where creativity flourishes and audiences trust the platforms they use.

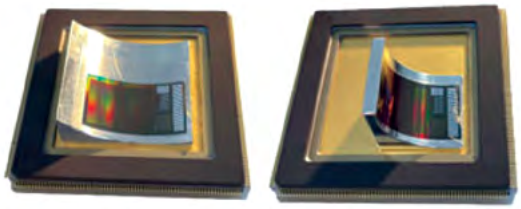
"Every legitimate subscription strengthens the industry, nurtures talent, and keeps stories alive," Euan said, reinforcing Astro's commitment to protecting the content ecosystem. [Content+Technology]

NHK STRL DEVELOPS WORLD'S FIRST 0.01 MM THIN, BENDABLE SILICON IMAGE SENSOR

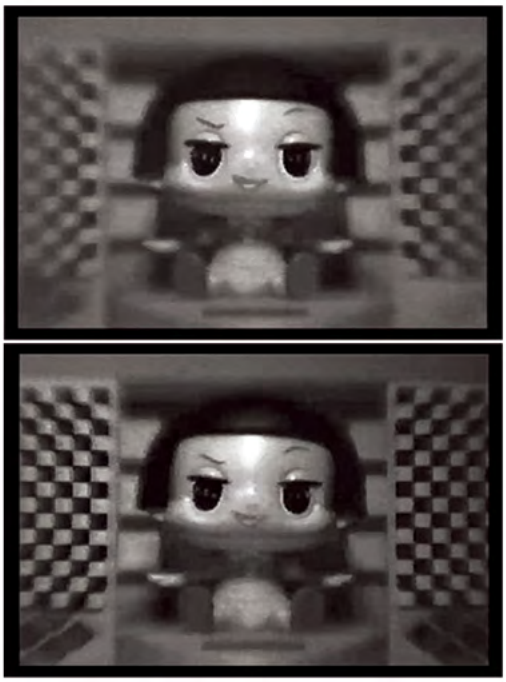
NHK Science & Technology Research Laboratories (STRL) is advancing research on innovative thin, bendable silicon image sensors to develop small, blur-free broadcast cameras featuring a wide field of view. STRL has achieved a significant breakthrough with the creation of the world's first thin, bendable silicon image sensor, which measures just 0.01 mm in thickness. This sensor effectively reduces horizontal blurring by operating in a curved configuration.

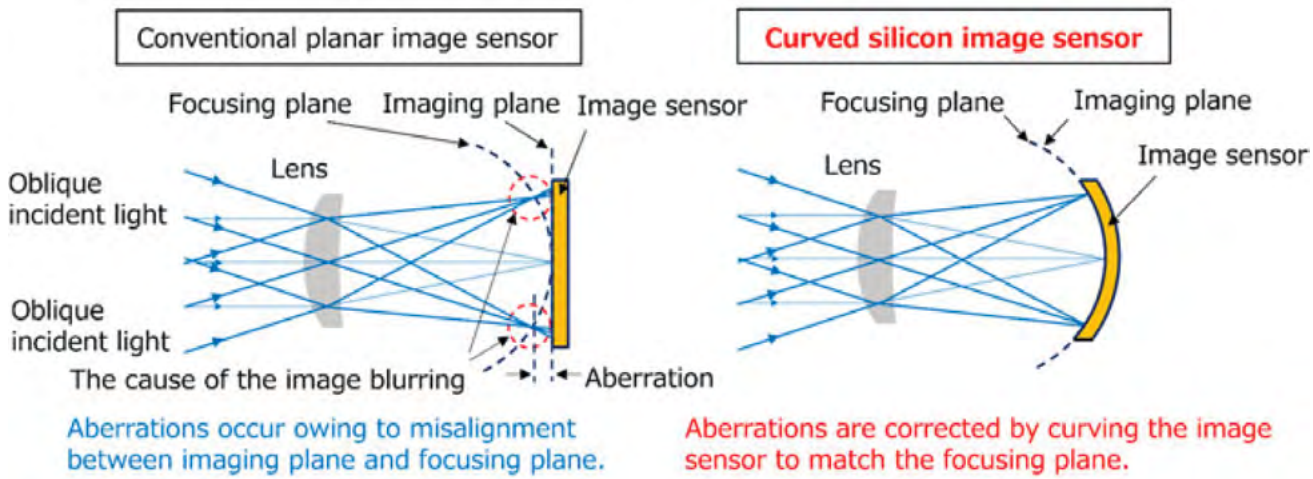
Image sensors are essential devices that convert light captured through lenses into electrical signals. Traditional planar image sensors can suffer from aberrations, causing blur at the edges of images due to misalignment between the imaging and focusing planes. This blurring is exacerbated when capturing wide fields of view. While aberrations are typically corrected by using multiple lenses, leading to bulkier cameras, STRL's approach involves curving the image sensor to align with the focusing plane, allowing for fewer lenses and thus enabling a more compact camera design without sacrificing image quality.





Radius of curvature: 20 mm Radius of curvature: 10 mm





A novel fabrication method using a thin oxide film between the silicon substrate and the silicon device layer has allowed the removal of the rigid silicon substrate. STRL successfully produced a thin silicon image sensor (320 x 240 pixels) that can capture images even when shaped into a cylinder with a radius of curvature of 10 mm, showing significant improvement in horizontal aberrations compared to traditional sensors.

The findings of this research were showcased at IEEE SENSORS 2024 in Kobe, Japan. Looking ahead, STRL plans to continue development on colorization and aims to fabricate concave curved image sensors that will enhance aberration correction in both vertical and horizontal dimensions. The goal is to commercialize a compact, lightweight camera with high image quality and a wide field of view by around 2030. [NHK STRL]

DRM AND ATSC SIGNS MUTUAL PARTNERSHIP AGREEMENT

The DRM Consortium and ATSC (Broadcast Standards Association) have signed a mutual institutional partnership agreement, granting each organization equal access and rights within the other. This collaboration aims to foster closer ties between the two international, non-profit entities, with the goal of promoting the global adoption of both Digital Radio Mondiale (DRM) and ATSC 3.0 standards. The partnership is expected to benefit broadcasters and listeners worldwide, supporting the growth of digital broadcasting technologies.

The DRM Consortium, with over 100 members, advocates for the worldwide adoption of DRM, the only universal, openly standardized digital radio system for all broadcasting frequencies. DRM is already being demonstrated and used in numerous countries, including India, China, Indonesia, South Africa, and several European nations. DRM offers a range of benefits, including better audio and data delivery, multimedia enhancements, and efficient use of spectrum and energy. Its multi-channel signals are broadcast from a single wide-band transmitter, showcasing its ability to deliver information, entertainment, and emergency warnings effectively.

ATSC, a key player in developing digital terrestrial broadcasting standards, has been advancing ATSC 3.0, a system designed to integrate broadcast and telecom standards. ATSC 3.0 is currently being tested in countries like India, Canada, Mexico, and Brazil, with ongoing deployments in the U.S. and South Korea. This next-generation broadcasting system aims to enhance broadcasting capabilities, provide high-quality digital radio, and expand opportunities for broadcasters worldwide. The partnership between DRM and ATSC will enable the integration of DRM services into ATSC 3.0 transmissions, particularly in regions like India, where DRM has a solid user base. Both organizations share a vision of delivering robust, end-to-end broadcasting solutions, particularly for both developed and developing countries. The agreement was welcomed by both parties, with DRM's Chairman, Ruxandra Obreja, expressing excitement about the potential joint initiatives that will arise from this collaboration. [DRM]

ABU SIGNS MOU WITH RTPRC-CHINA ON LICENSE AGREEMENT

At the 61st ABU General Assembly in Istanbul, the Asia-Pacific Broadcasting Union (ABU) formalized a partnership with the Radio and Television of the People's Republic of China (RTPRC) by signing a Memorandum of Understanding (MoU). Represented by Ms Zhou Jihong, Director General of the International Cooperation Department, RTPRC spearheaded this agreement, which centres on licensing Chinese television programs for broadcast. This collaboration is a strategic milestone aimed at enriching the media landscape among ABU members while fostering cultural exchange between the Asia-Pacific region and China.

The MoU highlights ABU's dedication to creating a platform for its members to access diverse and engaging programming. By facilitating the broadcast of Chinese content, the agreement reflects a broader mission to promote cooperation and mutual understanding among member organizations. Such efforts align with ABU's commitment to cultural diplomacy through media, enabling broadcasters to share stories and perspectives that transcend borders.

ABU Secretary-General Ahmed Nadeem emphasized the importance of the partnership, stating, "This MoU with RTPRC-China offers our members an opportunity to broaden their programming options with content from China, fostering greater understanding across our region". His remarks underscore the MoU's role in bridging cultural divides through media and enhancing the programming portfolios of ABU member broadcasters.

This initiative not only strengthens the ties between ABU and Chinese media but also provides a platform for exchanging creative ideas and content that reflect the region's rich diversity. By promoting cross-cultural dialogue and collaboration, the MoU signifies ABU's proactive approach to supporting its members in delivering high-quality, culturally inclusive programming, ultimately advancing the organization's mission of uniting broadcasters for mutual growth and understanding. [ABU News]

EBU WELCOMES NEW CHAIR FOR EBU TECHNICAL COMMITTEE

The European Broadcasting Union (EBU) has appointed a new Chair for its Technical Committee, marking a pivotal moment for its ongoing mission to support public service media (PSM). The new Chair brings a wealth of experience, having served as Technical Director at SWR and as Chair of the ARD Production and Technology Commission. With a background in guiding and uniting diverse stakeholders, the Chair likens the role to that of a conductor, harmonizing the varied needs of members to achieve cohesive goals.

The Chair recognizes the critical challenges facing the EBU, including audience fragmentation across digital platforms, which demands tailored strategies to engage diverse audiences while maintaining core public service values. Personalization, innovation, and relevance are key to thriving in an increasingly competitive media landscape. At the same time, securing data and content against cyber threats remains essential to preserving credibility and trust.

Under the Chair's leadership, the EBU will continue to champion PSM, ensuring the delivery of worldclass content across accessible platforms. This includes enhancing accessibility tools like subtitles, audio descriptions, and sign language interpretation to serve diverse audiences. The Chair emphasizes the role of data as a cornerstone of success, enabling a deeper understanding of audience needs and supporting AI-driven solutions to create personalized content experiences.

The EBU Technical Committee will also prioritize collaboration, fostering unified visions and teamworkamong its members to address complex

challenges effectively. As technological advancements like hybrid and cloud-based production and 5G integration reshape broadcasting, the Committee aims to remain at the forefront, promoting innovative solutions that align with the EBU's mission.

By leveraging collective strengths and embracing new opportunities, the Chair seeks to guide the EBU Technical Committee in navigating today's challenges while building a sustainable future for public service media. [EBU News]

VOICE OF VIETNAM COMPLETES PHASE TWO OF TRAFFIC RADIO MODERNIZATION WITH LAWO SOLUTIONS

Voice of Vietnam (VOV), one of Southeast Asia's most advanced state broadcasters, has completed the second phase of its traffic radio project in Hanoi and Danang, utilizing advanced audio solutions from Lawo. VOV, established in 1945, is Vietnam's national broadcaster, while Lawo is a global leader in innovative media production technologies. The project was executed in collaboration with Broadcast Communications International (BCI), a prominent system integrator in Southeast Asia.

The first phase, completed in 2020-21, introduced two Lawo ruby and two crystal radio broadcast consoles. Building on that success, the second phase included the deployment of three new diamond consoles, three additional crystal consoles, and two pairs of redundant Power Core routing devices.

The newly installed diamond consoles are IP-native and seamlessly integrated with VOV'sRAVENNA/AES67 network. Their highly customizable control surfaces allow operators to adapt systems to specific studio needs, providing flexibility and scalability for future expansions. Crystal consoles, known for their compact and efficient design, offer reliable, high-quality performance, streamlining daily broadcast tasks with an intuitive user interface.

At the system's core is a RAVENNA audio-over-IP network supported by robust Power Core routing devices. These devices ensure seamless audio signal routing, high-channel capacity, and flexible I/O options, adhering to RAVENNA/AES67 standards. The deployment of redundant Power Core systems enhances resilience, maintaining uninterrupted broadcasts even in hardware failure scenarios.

A VOV spokesperson highlighted the project's significance, emphasizing that the upgraded infrastructure modernizes operations while ensuring flexibility and reliability. This advancement enables VOV to consistently deliver high-quality content to audiences locally and internationally, marking a milestone in its commitment to innovation and excellence in broadcasting. [APB News]

OPEN-SOURCE PROGRAMME OFFICES STEP UP DIGITAL TRANSFORMATION

Developing digital public services presents significant challenges for nations and organizations undertaking extensive digital transformation projects. Open-source solutions offer a pathway to address these challenges by building local skills, fostering inclusive design, reducing redundancy, and accelerating the creation of a digital society and economy. However, effectively developing, deploying, and managing open source technologies can be a complex and resource-intensive endeavour.

Open Source Programme Offices (OSPOs) have emerged as key enablers for organizations aiming to maximize the potential of open-source technologies. These dedicated internal offices manage, promote, and guide the use, development, and release of open-source solutions. OSPOs establish policies, ensure compliance with licenses, advocate for best practices, and cultivate an open-source culture within institutions.

The International Telecommunication Union (ITU) is championing the OSPO concept to help countries and companies fast-track digital transformation. ITU's initiatives focus on leveraging open-source technologies to enhance digital public goods (DPGs) and digital public infrastructure (DPI) globally. These efforts aim to foster equitable socio-economic development through inclusive digital ecosystems.

Supported by the Tides Foundation and led by ITU's Telecommunication Development Bureau, ITU's OSPO project seeks to empower organizations globally to adopt and innovate using open-source technologies. The project aligns with international DPG initiatives such as GovStack, the Be Healthy Be Mobile project, and ITU's Open Source Ecosystem Enabler (OSEE).

Key activities under ITU's OSPO project include raising awareness about open-source technologies, promoting equitable economic inclusion, and creating capacity-building resources tailored to low- and middle-income countries. Additionally, the project supports community development through opensource software initiatives, legal guidance, and licensing support. ITU also collaborates with UN agencies to advance sustainability, environmental protection, and other global priorities.

Exploring the integration of open-source artificial intelligence (AI) further underscores ITU's commitment to enhancing digital public services. Open-source AI models are seen as promising tools to improve service delivery, accessibility, and efficiency in resource-constrained settings without significant financial burdens.

The success of these initiatives hinges on global collaboration. ITU emphasizes the importance of collective action to harness the transformative power of open source, building inclusive digital systems that foster lasting impact and leave no one behind. [ITU News] ■

DIGITAL BROADCASTING Updates

AVS3-P3 IMMERSIVE AUDIO ADDED TO DVB'S CODEC SOLUTIONS

The DVB Project has added the AVS3 Part 3 Immersive Audio (AVS3-P3) codec to its core specification for video and audio coding in broadcast and broadband applications. This codec, developed by China's Audio and Video Coding Standard Workgroup, is also the source of the AVS3 video codec adopted by DVB in 2022.

A new revision of the DVB-AVC specification, DVB BlueBook A001r22, was approved during last week's DVB Steering Board meeting and is now available.

The AVS3-P3 codec enhances the market potential of DVB solutions, particularly in China, by supporting advanced NGA (Next Generation Audio) features. It enables both lossy and lossless audio coding, along with NGA capabilities like loudspeaker and binaural rendering for virtual reality applications (3DoF). The codec also supports various audio formats, including channel-based, object-based, and scene-based audio coding, as well as multi-channel audio with multiple objects. Its metadata is compatible with the EBU's Audio Definition Model (ADM).

More than 20 vendors have joined the AVS3-P3 ecosystem, with successful trial transmissions paving the way for full deployment. DVB BlueBook A001r22 will now be submitted to ETSI for standardization as TS 101 154 V2.9.1. [DVB News]

LAWO UNVEILS SOFTWARE VERSION 10.12 FOR MC² AUDIO MIXING SYSTEMS

Lawo has introduced software version 10.12 for its latest mc² audio production consoles, bringing significant advancements in channel management, Waves integration, user experience, and system security. Designed for professionals in demanding audio environments, this update aims to enhance operational efficiency, flexibility, and production reliability. One of the key enhancements is the new Strip Assign page, which offers a modern and intuitive interface for managing channels. This feature allows users to assign single or multiple channels to fader strips in one step and effortlessly reassign, duplicate, or swap channels. It also enables direct customization of channel labels and fader strip colors, helping users tailor console layouts to their preferences. Additionally, a clear visual representation of console banks aligns sections with physical bays, streamlining navigation and saving valuable setup time during live and studio operations.

Version 10.12 also includes major improvements in Waves integration through the introduction of the ProLink protocol, replacing the older RFC protocol. This enhancement enables automatic label synchronization between mc² consoles and Waves SuperRack 14 systems, reducing manual entry errors and ensuring seamless communication. The new access channel linking feature allows engineers to open a connected Waves Rack with a single button press, providing quick access to plug-in adjustments. This streamlined workflow eliminates the need to navigate between systems, enabling engineers to focus on delivering high-quality sound.

The update further improves the user interface and workflow with new visual indicators in the Signal List, which display the status of Aliases, Waves, and Loopback connections. These updates simplify the management of signal paths by providing immediate feedback on signal health and connectivity. The enhanced icons and improved Signal List make it easier for operators to manage complex, multi-console setups with clarity and precision.

Overall, software version 10.12 delivers a robust set of features that enhance usability and performance for audio professionals. The updates in channel management, Waves integration, and signal path oversight reflect Lawo's commitment to innovation and excellence. By streamlining workflows and reducing operational complexity, this update empowers users to achieve greater efficiency and reliability in their production environments. [TV Technology]

ATSC STANDARDS UPDATE: TWO NEW DOCUMENTS APPROVED

Two important documents have been approved and published, marking significant advancements in ATSC standards. These documents are focused on enhancing physical layer capabilities and defining interactive content environments within ATSC 3.0 systems.

A/322:2024-04 Amendment No.1

This amendment introduces key enhancements to the physical layer of the ATSC 3.0 standard, enabling increased throughput and greater spectral flexibility. The document specifies the integration of Multiple Input Multiple Output (MIMO), Channel Bonding, Layered Division Multiplexing (LDM), and their combinations. These technologies are designed to significantly boost data capacity and offer flexible spectrum usage.

In addition to these improvements, the amendment incorporates TxID signal generation to ensure compliance with MIMO signal requirements. This enhancement supports advanced signal management and transmission capabilities. To provide a comprehensive reference, a roll-up version of the standard has also been published as **A/322:2024-09**.

A/344:2024-04 Revision

This **Candidate Standard** outlines the interactive content environment supported by ATSC 3.0 Receivers. It describes

an ecosystem that includes:

- A standard W3C User Agent with well-defined characteristics.
- A WebSocket interface for obtaining information from the Receiver and managing its functionality.
- An HTTP interface for accessing files delivered via broadcast.

The document also specifies the lifecycle of interactive content delivered through broadband, broadcast, or a combination of both. These specifications aim to standardize the user experience across ATSC 3.0 Receivers, ensuring compatibility and seamless interaction between broadcast and broadband environments.

The Candidate Standard review period for **A/344:2024-04** extends until **28 February 2025**, allowing time for feedback and further refinement before its final adoption. [ATSC]

RESEARCH ON HIGH-FRAME-RATE TECHNOLOGY USING CODED APERTURE IMAGING

To achieve a high-definition 3D imaging system, research is being conducted on incoherent digital holography (IDH)*1, which enables the capture of holograms under natural light conditions such as sunlight. For high-quality hologram acquisition, a camera with a large-format, high-resolution image sensor is essential. However, in an IDH imaging system, achieving high frame rates is challenging due to the limited bandwidth of the readout circuit. To address this, researchers are exploring high-frame-rate technology through coded aperture imaging.

Principle of High-Frame-Rate Imaging with Coded Aperture

Coded aperture imaging employs a binary black-and-white coding pattern placed between the object and the camera (***Figure 1***) to encode the object image. During the capture of a single frame by the camera, the coding pattern switches multiple times. By solving equations based on the captured image and the coding patterns, a continuous sequence of frames can be reconstructed. This approach enables the camera to achieve frame rates beyond its inherent capabilities.

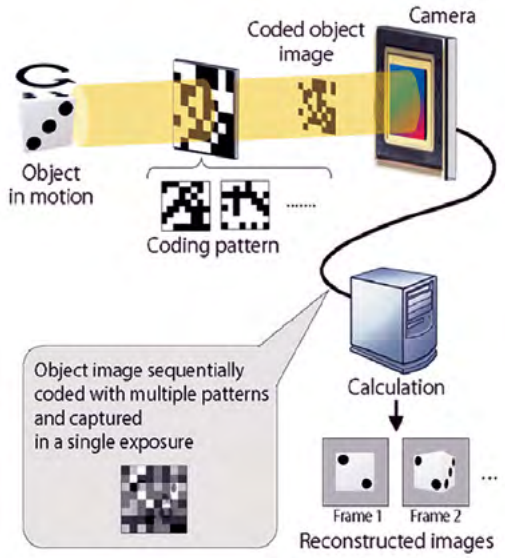


***Figure 1**: Principle of high-frame-rate using coded aperture imaging*

Enhancements to Image Quality

Conventional coded aperture imaging methods often result in degraded reconstructed image quality, as the coding pattern blocks some of the light rays from the object. To address this limitation, a new optical system*2 was developed that minimizes light loss (***Figure 2***).

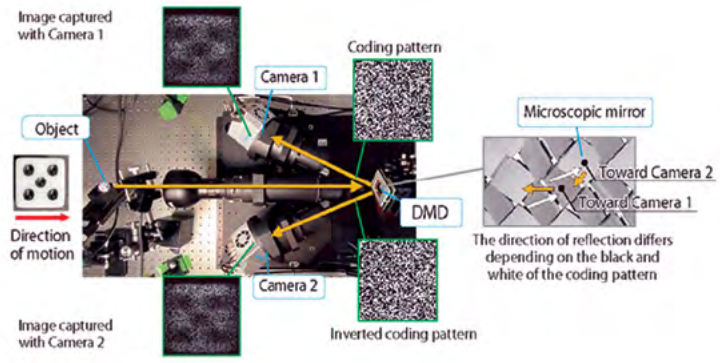


***Figure 2**: Optical system for simultaneously capturing two coded object images*

In this innovative optical system, the object image is first projected onto a digital micromirror device (DMD)*3. The DMD's mirrors are controlled according to the coding pattern's black-and-white distribution. Light rays reflected in two distinct directions are captured by two cameras. This setup enables simultaneous capture of the object image encoded with the coding pattern and its inverted version, ensuring no light loss.

Experimental results confirmed that this optical system can reconstruct images with higher quality and frame rates than the camera's native capabilities (***Figure 3***).

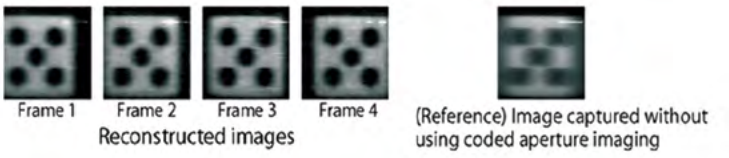


***Figure 3**: Example of capturing a dice moving horizontally*

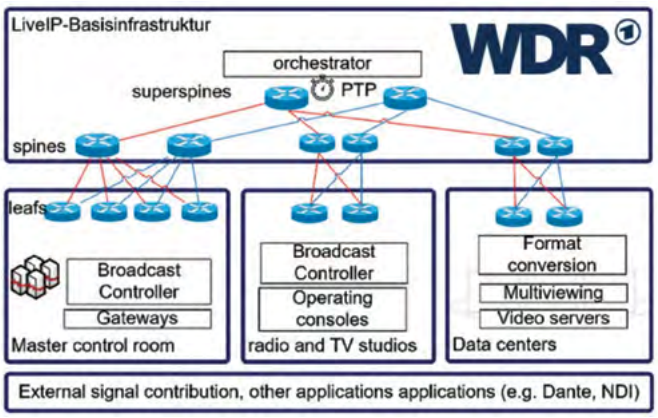
Future Directions

The next step involves integrating coded aperture imaging technology with the IDH imaging system to capture high-definition 3D information. This combination holds promise for advancing the capabilities of 3D imaging under natural light conditions. [NHK STRL]

EVOLUTION OF BROADCAST INFRASTRUCTURE AT WDR: EMBRACING ST 2110 IP-BASED SOLUTIONS

The broadcasting industry is rapidly evolving, with the migration to ST 2110 IP-based infrastructures becoming increasingly prominent. This transition marks a significant step towards more software-centric infrastructures, where high-performance networks play a critical role. These networks are required not only to support ST 2110 broadcast streams but also to accommodate a variety of other applications within broadcast production, forming a unified or converged broadcast network.

Live IP infrastructure, one network fabric with an orchestrated layer for ST 2110



Converged Broadcast Network

One of the primary benefits of transitioning to IP-based infrastructures is the consolidation of multiple applications onto a single network. Traditional approaches often necessitate separate networks for functions such as video production, editing, and distribution. By contrast, a converged network enables the integration of these applications into one underlay fabric, supported by different overlay networks.

For instance, a video server requires media streams, high-bandwidth file transfers, and low-latency control traffic. Traditionally, this would demand three separate networks, or two in cost-constrained scenarios. A converged network approach, however, fulfills these requirements through a unified infrastructure, simplifying management and reducing costs. This concept has been proven in telecommunications and data centers, where multiple applications and clients are securely managed within the same network.

To successfully implement a converged network, meticulous planning and automation are essential. Tools such as Ansible, an open-source IT automation engine, enable automated configuration and deployment. This reduces the complexity traditionally associated with command-line configurations, resulting in a more resilient and efficient network operation.

Skill Requirements for Modern Broadcast Teams

The successful transition to ST 2110 and a converged network demands expertise in both networking and media applications. Breaking down traditional silos between network and broadcast engineering is critical, fostering collaboration among teams to manage and optimize the new infrastructure effectively.

Unlike the traditional facility-based project approach – where studios and facilities were upgraded holistically – future projects will focus on technology layers. This shift emphasizes continuous integration, testing, and deployment, enabling teams to adapt rapidly to changes and future requirements. Collaboration and agility are key to ensuring seamless operations in a software-driven environment.

The WDR Approach: LiveIP Base Infrastructure

At WDR, the implementation of a converged network is referred to as the "LiveIP base infrastructure". This setup is designed to prioritize real-time ST 2110 applications while integrating control and file-transfer traffic from the outset. The network configuration is role-based and managed using Ansible playbooks, ensuring consistent and automated deployment.

Future projects at WDR will operate as tenants of this infrastructure, eliminating the need to design new networks for each project. This unified approach aligns with the broader goal of transitioning to fully software-based production facilities, as envisioned by the EBU Dynamic Media Facilities group. Such facilities aim to migrate from dedicated hardware to virtualized platforms hosted either in on-premises data centers or the cloud.

The migration to ST 2110 IP-based infrastructures and the adoption of converged networks represents transformative steps for the broadcasting industry. By consolidating applications onto a single network and leveraging automation tools like Ansible, broadcasters can achieve greater efficiency, cost savings, and operational flexibility. The shift to technology-layered approaches further supports the transition to software-based production facilities, paving the way for virtualization and cloud integration.

Organizations like WDR are leading the way with innovative strategies, demonstrating the potential of converged networks to meet the demands of modern broadcasting while preparing for future technological advancements. [EBU News]

THE FUTURE OF TELEVISION IN EUROPE

The European television industry is undergoing significant change, driven by new regulations and shifting viewer habits. Traditional broadcasting is merging with digital streaming, creating hybrid models that offer audiences seamless access to live and on-demand content. This evolution enhances viewer choice and intensifies competition among broadcasters.

Broadcasters are using digital tools to boost interactivity and personalization, ensuring traditional TV remains relevant in a digital-first world. Joanne Wilson, Deputy Director of ITU's Radiocommunication Bureau, noted that the convergence of traditional broadcasting and Internet services has made TV central to daily life, accounting for 80% of consumer Internet traffic.

At the "Future of Television in Europe" workshop held by ITU on 7 November in Geneva, experts discussed how emerging technologies can modernize broadcast infrastructure and services. ITU's 75 years of experience in broadcasting standards continues to play a vital role in making high-quality TV accessible worldwide.

The Growth of Streaming

Streaming services have grown rapidly over the past two decades, reshaping viewer expectations. European broadcasters are adapting by launching digital platforms

to provide flexible and convenient viewing options. Public broadcasters face the challenge of innovating while maintaining their traditional roles of cultural preservation and impartial news delivery.

For instance, the UK's BBC, ITV, Channel 4, and Channel 5 have launched a joint service, "Freely," which streams live TV and on-demand content online, eliminating the need for satellite dishes or aerials. This service simplifies live TV access while preserving cultural diversity.

Technological Advances
New technologies like AI, 5G, cloud platforms, and AR/VR are transforming TV experiences. These innovations enable interactive storytelling, immersive sports broadcasts, and real-time streaming with ultra-low latency.

The Paris 2024 Olympics showcased private 5G networks, which provided seamless, high-quality coverage and enhanced interactive features for spectators. Mark Jordan of Arqiva highlighted the importance of hybrid systems, combining streaming and terrestrial networks for cost-effective content delivery.

Regulatory Support
European regulations, such as the Digital Services Act and Digital Markets Act, support local content creation, cultural diversity, and fairness between broadcasters and online platforms. Jenny Weinand of the European Broadcasting Union emphasized that these regulations protect the independence and credibility of public broadcasters.

Television in Emergencies
Broadcast TV remains essential for emergency communication, informing the public during crises. New tools like 5G, AI, and DVB-I are enhancing broadcasters' ability to respond effectively. Doris Martiza Delgado from ITU highlighted the role of cross-border collaboration in ensuring public safety through television.

By blending tradition with innovation, embracing technology, and adapting to regulatory changes, European broadcasters are shaping a dynamic and diverse media landscape that balances their cultural roots with modern viewer demands. [ITU News]

DRM PRESENTS STRONG ARGUMENTS ON FM DIGITISATION TO INDIAN REGULATOR

At the end of September, the Indian regulator TRAI initiated a consultation on a Digital Radio Broadcast Policy for private broadcasters to determine how best to digitize the FM frequency band (VHF Band II), a crucial spectrum for public and commercial broadcasting. The consultation, divided into two phases, aimed to gather input from stakeholders. The first phase, focusing on the strongest arguments for digitization, ended in October, while the second concluded on November 11. Two key standards are being considered: **DRM (Digital Radio Mondiale)**, an open, international standard already deployed in India for AM radio, and **HD Radio**, a proprietary system promoted by the US-based company Xperi. A consensus emerged during the consultation that adopting a single standard would benefit listeners, broadcasters, and manufacturers by ensuring consistency and ease of use. Given DRM's widespread presence in India, with millions of vehicles already receiving DRM AM signals, it is seen as the leading candidate for FM digitization.

DRM offers numerous advantages that make it a strong contender. It is a non-proprietary, open standard endorsed by ITU and ETSI, compatible across all broadcast bands (AM, FM, and SW), and designed to be spectrum- and energy-efficient. Using the advanced xHE-AAC codec, DRM delivers high-quality audio and multimedia services, including emergency alerts and multilingual text information, without requiring an internet connection. Each DRM block can host up to three audio programs and one multimedia service, with the ability to operate in simulcast mode (digital and analog signals from the same transmitter) or pure digital mode with simulcast options. Additionally, DRM utilizes unused spectrum (white spaces) between FM signals, allowing multiple broadcasters to operate efficiently, with up to five DRM blocks fitting within a 600 kHz gap. Importantly, DRM requires no licensing fees, reducing costs for broadcasters and manufacturers, and it supports India's diverse linguistic and cultural needs through its advanced text service, Journaline.

The ecosystem for DRM adoption is already well-established. DRM receivers, desktop radios, and Android apps are available in India, and existing FM hardware in mobile devices can be enabled for DRM through software updates. The automotive sector has embraced DRM, with over six million cars in India equipped for DRM AM reception. Recent trials have demonstrated that DRM FM-band functionality can be activated in vehicles through software updates alone, creating an immediate market for DRM FM services. Indian companies like Inntot and OptM are leading innovations in DRM technology, contributing to both local and global markets under the "Make in India" initiative.

Globally, DRM is gaining momentum, with adoption expanding in countries like Indonesia, Pakistan, and China. This international progress, coupled with India's existing DRM infrastructure and readiness, positions DRM as the most practical and forward-looking solution for FM digitization in India. [DRM News] ■

Equipment Trends

DJI AIR 3S: A NEW ERA IN AERIAL PHOTOGRAPHY WITH DUAL-CAMERA TECHNOLOGY

Photography is not merely about capturing moments; it is about discovering fresh perspectives and transforming ordinary scenes into extraordinary visual narratives. Aerial photography offers endless possibilities – sweeping vistas, dynamic urban landscapes, and detailed close-ups – all viewed from above. DJI has been a leader in advancing this art form, and their latest release, the Air 3S, presents another significant milestone.

Released in October 2024, the DJI Air 3S features a dual-camera system that enables users to explore aerial photography with enhanced flexibility and precision. Designed to meet the needs of a broad spectrum of users, including travel enthusiasts, professional photographers, and beginners, this drone integrates advanced technology with user-friendly features. From high-dynamic-range (HDR) video capture to smooth navigation in challenging environments, the Air 3S is a notable development in aerial imaging.

This device offers an opportunity to push creative boundaries with its superior imaging capabilities, extended flight duration, and robust safety features. Whether scaling mountain peaks or navigating urban environments, the Air 3S provides tools for capturing the world from unique perspectives.

Highlights of the DJI Air 3S:

- *Dual-Camera System: Features a 50MP wide-angle and 48MP medium telephoto camera, allowing for exceptional image quality and versatility.*

- *HDR and Slow-Motion Video: Offers 4K/60fps HDR recording and 4K/120fps slow-motion for cinematic-quality content.*
- *Free Panorama Function: Enables flexible wide-angle shooting for landscapes and intricate details alike.*
- *Advanced Obstacle Sensing: Nightscape sensors, including LiDAR and infrared, ensure safe navigation in low-light conditions.*
- *Extended Flight Time: Boasts a maximum flight time of 45 minutes, giving users ample room to explore.*
- *Smart Return-to-Home (RTH): Utilizes vision positioning and real-time mapping for accurate and safe returns.*
- *O4 Transmission System: Provides a range of up to 20 km with high-definition video streaming.*

The DJI Air 3S combines portability, performance, and precision, offering a practical tool for aerial photographers and videographers. Its features are designed to support users in capturing and sharing unique perspectives through aerial imagery.

Whether used by seasoned professionals or those new to aerial photography, the Air 3S provides a platform for exploring creative possibilities and refining visual storytelling. [DJI]

SMALLHD UNVEILS ULTRA 10: REDEFINING PORTABLE MONITORING EXCELLENCE

In the demanding environment of production, where precision and efficiency are paramount, the appropriate tools play a significant role in determining the final outcome. For focus pullers, directors, and digital imaging technicians, a reliable production monitor is not merely a tool but an essential component in achieving their

creative vision. The SmallHD Ultra 10 is a recent addition to the market, designed to combine portability with advanced performance to meet the needs of contemporary production teams.

The 10-inch Ultra 10 monitor bridges the gap between compact on-camera monitors and larger production displays, offering a versatile solution for professionals. Whether deployed during dynamic outdoor shoots or in complex studio setups, the Ultra 10 incorporates key features aimed at supporting seamless workflows and improving production efficiency.

Key Features of Ultra 10:

- *High Brightness Display: A 2000-nit, 1920 x 1200 touchscreen ensures clear visibility in any lighting condition.*
- *Advanced Connectivity: Equipped with 6G-SDI and HDMI 2.0 inputs/outputs, supporting 4K30 workflows effortlessly.*
- *Rugged Design: With an IP54 weatherproof rating, it is built to withstand demanding production environments.*
- *Integrated Wireless Capabilities: Compatible with Teradek Bolt 4K and Bolt 6 platforms for streamlined wireless transmission.*
- *Camera Control Integration: Optional licenses enable direct control of ARRI, RED, and Sony VENICE cameras.*

With its lightweight construction and robust feature set, the SmallHD Ultra 10 exemplifies innovation in production technology. Its capabilities align with the needs of professionals seeking both reliability and portability in their equipment. The Ultra 10 serves as a practical addition to production workflows, enabling users to effectively address modern challenges. [SmallHD]

ZEISS UNVEILS SUPREME ZOOM RADIANCE: REDEFINING THE ART OF CINEMATIC IMAGERY

Cinematography is a craft that combines artistic vision with technical precision, where each frame conveys a story and every lens plays a critical role in capturing that narrative. For decades, ZEISS has been a trusted name in lens manufacturing, shaping the way cinematic stories are brought to life. With the launch of the Supreme Zoom Radiance series, ZEISS introduces a new benchmark in visual storytelling, offering a combination of functionality and creative expression that aligns with the demands of

contemporary filmmaking.

The Supreme Zoom Radiance lenses are designed to do more than capture a scene; they are intended to elevate the narrative through controlled artistic flares and warmer color tones. Utilizing the signature ZEISS T* blue coating, these lenses provide filmmakers with a distinctive and reproducible visual palette. Whether working on a grand cinematic feature or an intimate indie project, the Supreme Zoom Radiance lenses aim to support storytelling at the highest level of artistry.

Key Features of Supreme Zoom Radiance:

- *Lens Options: Three focal lengths – 15-30mm, 28-80mm, and 70-200mm – all with a consistent T2.9 aperture.*
- *Visual Aesthetics: Signature T* blue coating for reproducible flares and a cohesive look across setups.*
- *Versatility: Gentle sharpness, smooth focus fall-off, and elegant bokeh for a cinematic feel.*
- *Ergonomic Design: Standardized positions for iris, focus, and zoom rings, ensuring seamless interchangeability.*
- *Lens Data Support: ZEISS extended Data technology for precise frame-by-frame metadata, ideal for VFX and virtual production.*

The Supreme Zoom Radiance lenses are designed for compatibility with other ZEISS primes or mixed-lens setups, providing flexibility in various production environments. With their technical precision and visual characteristics, these lenses support filmmakers in achieving their creative and storytelling goals. [ZEISS]

LIFTO 25: ELEVATING PTZ CAMERA CREATIVITY AND CONTROL

The evolving landscape of production is increasingly shaped by robotics and automation, redefining how stories are captured and presented. The LIFTO

25, a motorized elevation column developed by Cartoni, represents a significant innovation in enhancing the functionality of PTZ cameras. Whether used in a bustling newsroom, a dynamic talk show set, or a serene house of worship, the LIFTO 25 expands creative possibilities through precise and smooth vertical motion.

Designed to integrate vertical movement seamlessly with the pan, tilt, and zoom capabilities of PTZ cameras, the LIFTO 25 offers a new dimension of creative control. Its lightweight and robust construction, combined with intuitive operation, makes it a valuable tool for professionals aiming to bring increased dynamism and sophistication to their visual storytelling.

Key Features of LIFTO 25:

- *Compact and Lightweight: Weighs just 11.8 kg (26 lbs) and supports a maximum payload of 25 kg (55.1 lbs).*
- *Precision Motion: Offers smooth vertical transitions with a speed of 38 mm/s and a stroke of 660 mm (26 in).*
- *Versatile Height Adjustments: Extends from 572 mm (22.5 in) to a maximum of 2500 mm (98.4 in).*
- *Sturdy Design: Built on the Cartoni SDS tripod structure for unmatched stability and vibration-free operation.*
- *Intuitive Control: Operates via wired or Bluetooth connectivity, with options for remote automation.*

Equipped with a silent motor actuator and designed for broadcast-quality performance, the LIFTO 25 integrates seamlessly with leading PTZ camera systems, offering production teams a practical solution for incorporating vertical movement into their visuals. This motorized elevation column supports modern video production workflows and enables a wider range of creative possibilities. [LIFTO]

SHURE MV7+: ELEVATING PODCASTING AND STREAMING WITH ADVANCED AUDIO TECHNOLOGY

In the realm of content creation, audio quality is a critical factor in distinguishing good productions from exceptional ones. Whether for podcasting, live streaming, or musical recording, achieving clear and rich sound is essential. The Shure MV7+ Podcast Microphone, launched in April 2024, is designed to address the diverse needs of modern creators. Drawing inspiration from the renowned SM7B, this dynamic microphone combines professional-grade performance with accessible features, offering an adaptable audio solution for users at all levels.

Key Features of the Shure MV7+:

- *Hybrid Connectivity: Offers USB-C and XLR outputs, ensuring flexibility for both studio and home recording setups.*
- *Voice Isolation Technology: Focuses on your voice while effectively minimizing background noise, ideal for any recording environment.*
- *Customizable LED Touch Panel: Allows effortless control of microphone settings with a palette of 16.8 million colors for personalized aesthetics.*
- *Enhanced DSP Capabilities: Features Auto Level Mode, digital pop filter, real-time denoiser, and reverb effects for polished recordings.*
- *Integrated Headphone Monitoring: Includes a built-in headphone jack for latency-free monitoring, ensuring precision during live sessions.*
- *Robust Build Quality: Designed for durability, making it reliable for long hours of recording or streaming.*

The Shure MV7+ microphone is designed for versatile use across various applications, including podcasting, music production, and live streaming. Its voice isolation technology helps to maintain audio clarity in acoustically challenging environments, while the customizable touch panel provides convenient control over settings.

By combining advanced technology with straightforward functionality, the MV7+ supports creators in achieving reliable sound quality with minimal effort, whether in a home studio or a mobile setup. Its design prioritizes practicality, offering a dependable solution for a wide range of recording needs. [Shure]

ARRI LAUNCHES SKYPANEL S60 PRO: A NEW ERA OF LIGHTING VERSATILITY

Lighting serves as more than just illumination; it is a vital component of storytelling, capable of evoking emotion and shaping narratives. For filmmakers, event organizers, and broadcast professionals, the interplay of light and shadow is a powerful tool for visual communication. Recognizing the importance of innovative lighting solutions, ARRI introduces the SkyPanel S60 Pro, an evolution of the widely acclaimed SkyPanel S60-C. This latest offering redefines versatility, precision, and usability, providing creative professionals with a lighting solution designed to enhance their artistic vision.

The SkyPanel S60 Pro represents more than an upgrade; it is a reimagined lighting fixture designed to address the dynamic demands of modern productions. From independent filmmakers seeking cinematic lighting effects

to event producers managing intricate setups, the SkyPanel S60 Pro offers enhanced performance and intuitive control. Its advanced technology and refined design make it a valuable addition to any lighting toolkit.

Key Enhancements of SkyPanel S60 Pro:

- *Integrated Power Supply: Simplifies setups by eliminating external power components, reducing clutter and enhancing portability.*
- *Advanced Connectivity: Features built-in wireless CRMX and Bluetooth, along with DMX and Ethernet ports, ensuring compatibility with modern control systems.*
- *Digital Twin Technology: Enables a virtual replica of the fixture within Unreal Engine, optimizing pre-production planning and on-set adjustments.*
- *Improved Light Output: Offers 20% more brightness than its predecessor and features four individually controllable LED zones for superior pixel control.*
- *Expanded Color Temperature Range: Ranges from 2,800K to 10,000K, providing flexibility and unmatched color fidelity for diverse lighting scenarios.*

The SkyPanel S60 Pro maintains compatibility with all existing S60-C accessories, enabling an efficient transition for users already familiar with the previous model. Available in blue/silver and all-black finishes, it is engineered to address the requirements of both studio and location-based productions.

With its advanced features and practical design, the SkyPanel S60 Pro offers professionals enhanced lighting control for diverse production needs. Its updated capabilities reflect ongoing advancements in lighting technology, providing tools to support creative workflows effectively. [SkyPanel]

BLACKMAGIC MICRO STUDIO CAMERA 4K G2: REDEFINING COMPACT BROADCAST QUALITY

In the fast-paced world of live production, the need for versatile, high-quality, and discreet camera equipment continues to grow. Blackmagic Design addresses this demand with the Micro Studio Camera 4K G2, a compact and robust camera designed to deliver broadcast-quality Ultra HD capabilities in challenging and confined shooting environments.

Key Features of the Blackmagic Micro Studio Camera 4K G2:

- *Compact and Durable Design: Built with a magnesium alloy core, the camera features a body that is only slightly larger than its lens mount, ensuring durability while allowing for discreet placement in tight spaces.*

Exceptional Low-Light Performance: Offers a dual native ISO of 400 and 3200, with gain adjustable from -12dB (100 ISO) to +36dB (25,600 ISO), ensuring clear, low-noise imagery even in dimly lit conditions.

- *Versatile Lens Compatibility: Equipped with an active Micro Four Thirds (MFT) lens mount, the camera supports a wide range of lenses, including affordable MFT options and professional broadcast lenses through appropriate adapters.*
  Advanced Connectivity: Includes 12G-SDI Micro BNC connectors that support 10-bit uncompressed video up to 2160p60 and two-channel audio output, integrating seamlessly into professional broadcast workflows.

- *USB-C Expansion Port: This high-speed port enables recording high-quality 12-bit Blackmagic RAW files directly to external disks, network control, and connection to various accessories, enhancing flexibility in production setups.*
- *Integrated Color Correction and Control: The built-in color corrector and lens control can be managed via SDI and HDMI connections, allowing for real-time adjustments during live broadcasts.*
- *Professional Audio Integration: Featuring built-in microphones and support for external mics, the camera embeds audio into SDI and HDMI video outputs, ensuring perfect audio-video synchronization.*

The Blackmagic Micro Studio Camera 4K G2 is designed to accommodate various professional applications, including television production, broadcast news, sports coverage, education, conference settings, and houses of worship. Its compact form factor facilitates flexible camera placements, enabling the capture of unconventional angles that enhance visual storytelling. Despite its small size, the camera incorporates cinematic color science and supports log gamma, allowing users to achieve a professional aesthetic directly in-camera.

By integrating advanced technology with a compact design, the Blackmagic Micro Studio Camera 4K G2 offers a practical option for live production workflows. Blackmagic Design aims to provide tools that balance quality and flexibility, catering to the evolving needs of modern broadcasting environments. [Blackmagic] ■

ABU ANNOUNCES NEW LEADERSHIP AT THE 61ST GENERAL ASSEMBLY

On 23 October, the Asia-Pacific Broadcasting Union (ABU) introduced its new leadership team during the 61st General Assembly in İstanbul, Türkiye. This year's election underscores ABU's commitment to fostering regional collaboration and driving innovation across the Asia-Pacific broadcasting community.

Professor Mehmet Zahid Sobaci, Director-General of Türkiye's national broadcaster TRT, continues as ABU President, supported by Mr Inoue Tatsuhiko, Executive Vice-President of NHK-Japan. Joining them are two newly elected Vice-Presidents, Ms Zhou Jihong of NRTA/RTPRC-China and Dr Ignatius Hendrasmo of RRI-Indonesia, both of whom bring fresh perspectives and extensive expertise to the ABU leadership.

Ms Zhou Jihong (NRTA/RTPRC-China)

Ms Zhou Jihong serves as the Director-General of the International Cooperation Department at NRTA. Since her appointment as Deputy Director-General in 2014 at the State Administration of Press, Publication, Radio, Film, and Television (SAPPRFT, now NRTA), she has played a pivotal role in strengthening China's international media collaboration. She also contributed to the development of television drama content during her tenure at NRTA's Television Drama Department from 2019 to 2021.

In her current role, Ms Zhou leads global partnerships in the audio-visual sector, promoting cultural exchange and international cooperation. Her academic contributions include research on global communication trends and emerging media challenges, reflecting her dedication to advancing international dialogue.

Dr Ignatius Hendrasmo (RRI-Indonesia)

Dr Ignatius Hendrasmo, President Director of RRI, has a distinguished career spanning media, education, and public communication. Beginning as a host for RRI's student programs, he later held roles at BBC Indonesia and Internews Indonesia before serving as an advisor to the Indonesian Ministry of Communication and Information Technology.

One of Dr Hendrasmo's key achievements is the launch of the RRI Digital platform, designed to engage digitally savvy audiences and diverse social groups. He holds advanced degrees in political communication and political science from institutions in Indonesia and the UK, showcasing his academic depth and leadership vision.

Inoue Tatsuhiko (NHK-Japan)

Inoue Tatsuhiko joined NHK as a news reporter in 1980, beginning his career at NHK Nagasaki Station. Specializing in politics and foreign affairs from 1986, he became head of the Political News Division in 2005 and later served as Controller of Editing. Following the Great East Japan Earthquake in 2011, he was appointed Director of the Programming Department, overseeing NHK's programming, including disaster-related news coverage.

In 2014, he joined NHK's Executive Board as Senior Director, contributing to corporate planning. From 2016, he led NHK's technical affiliates, NHK I-Tech and B-SAT, for six years. In 2023, he was appointed NHK's Executive Vice President in recognition of his expertise and leadership. He was also elected Vice President of ABU, becoming the eleventh NHK representative to hold the position.

With this dynamic and diverse leadership team, ABU is well-positioned to drive innovation, collaboration, and cultural exchange in the rapidly evolving media landscape. [ABU] ■

NEW TLO FROM KBS

Mr Hueng Sug Kim is a dedicated professional currently serving as the International Events Project Manager in the International Cooperation Department at KBS.

He began his career at KBS in 2013, spending four years in Changwon, where he focused on RF transmission and program production. His responsibilities included managing TV, FM, and AM transmissions, as well as handling VCR equipment and lighting tasks.

In 2018, he transitioned to the Network Operation Department, taking on comprehensive management responsibilities. Subsequently, he moved to the Transmission Facility Department, where he spent five years overseeing critical projects. These included the launch of UHD transmission systems, the replacement of aging DTV and FM transmission systems, and the renewal of medium-wave antennas.

Most recently, Mr Kim has taken on the role of International Events Project Manager, where he contributes his expertise to KBS's global initiatives.

ABU TECHNOLOGY CALENDAR *of Events* 2025

23	January	Technology Webinar VYPA - NETSTAIRS	Online
10-14	February	HFCC A25 Conference	Abu Dhabi, UAE
24-27	February	21st ABU Digital Broadcasting Symposium (DBS 2025)	Kuala Lumpur, Malaysia
	March	Engineering Fundamentals Level 1	Online
16-17	April	ABU Technical Bureau Mid-Year Meeting	Kuala Lumpur, Malaysia
22-25	April	CCBN - ABU NEXUS Event	Beijing, China
	May	DRM Workshop	Online
13-15	May	CABSAT 2025	Dubai, UAE
27-29	May	Broadcast Asia 2025	Singapore
	TBC	WBU Technical Committee	*TBC*
	June	Members Innovation Webinar	Online
15-17	July	WorldDAB-ABU-ASBU Workshop	Online
23-25	July	ABU AI Forum	Kuala Lumpur, Malaysia
	August	Technical Workshop (Collaboration with IPPTAR)	Kuala Lumpur, Malaysia
	September	Members Innovation Webinar	Online
	September	ABU Technical Bureau Annual Meeting	Ulaanbaatar, Mongolia
	September	ABU Technical Committee Meeting	Ulaanbaatar, Mongolia
	September	ABU General Assembly	Ulaanbaatar, Mongolia
	November	Members Innovation Webinar	Online