





OUTCOME REPORT

<p>ITUEvents</p> <h2>ITU Workshop on the Future of Television for Europe</h2> <p>19 November 2021 9:00 – 13:00 Online</p> <p>Follow us on Twitter: @ITUEurope, @ITUStandards Join us online! http://www.itu.int/go/4KAG</p> <p><small>Organized within the framework of the ITU Regional Initiative for Europe on Broadband infrastructure, broadcasting and spectrum management and ITU Study Groups responsible for the standardization of Television, namely ITU-T SG9 and ITU-R SG6</small></p>	<table border="1"><tr><td>ENABLING ENVIRONMENT</td><td>ACCESSIBLE TELEVISION</td><td>MARKET TRENDS</td><td>TECHNOLOGY TRENDS</td><td>CHALLENGES & OPPORTUNITIES</td></tr></table>  <p>Organized by </p>	ENABLING ENVIRONMENT	ACCESSIBLE TELEVISION	MARKET TRENDS	TECHNOLOGY TRENDS	CHALLENGES & OPPORTUNITIES
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ITU Workshop on "The Future of Television for Europe" 19 November 2021

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1. INTRODUCTION

The ITU Workshop on "[The Future of Television for Europe](#)" took place virtually on 19 November 2021, collocated with the meeting of the ITU-T Study Group 9 (Broadband Cable and TV), held virtually from 15-24 November 2021. It was jointly organised by the three sectors of the ITU, the Development Bureau (BDT), the Standardization Bureau (TSB) and the Radiocommunication Bureau (BR), continuing the successful series of workshops and events such as "[The Future of Television for Asia & Pacific](#)" (Fully Virtual, 23 April 2021), "[The Future of Television for Europe](#)" (Geneva, 7 June 2019), "[The Future of Television for the Americas](#)" (Bogotá, 26 Nov 2018) and "[Future of Cable TV](#)" (Geneva, 25-26 January 2018).

The workshop was conducted with the support of the ITU Office for Europe, within the context of the European Regional Initiatives on Broadband infrastructure, broadcasting and spectrum management. The workshop is also supported by the ITU-T SG9 (Cable broadband and TV), ITU-T SG16 (Multimedia), ITU-R SG6 (Broadcasting service) as well as ITU-D SG1/Q2 (Strategies, policies, regulations and methods of migration and adoption of digital broadcasting and implementation of new services).

The aim of the workshop was to discuss the future of television for Europe with relevant stakeholders, covering regulatory and policy frameworks, emerging and convergent ICT Infrastructures and services, as well as user interfaces and accessibility issues. It also provided an opportunity to discuss TV-related regional and international standardization and to share best practices and case studies on TV implementations over various media as well as new TV services. The role of television as a reliable source of information and means to provide entertainment was also discussed, including how the television can help solve societal challenges introduced by the lockdown during the COVID-19 pandemic. Key topics covered by the workshop included:

- Session 1: National and European plans for television
- Session 2: The future user experience for television
- Session 3: The future content creation for television
- Session 4: The future content delivery for television

The main outcomes of the workshop are outlined in this report, including the key points emerged during each session.

2. PARTICIPATION

The Forum mainly targeted ITU Member States, Sector Members, Associates, ITU Academia, any individual from a country which is a member of the ITU and who wishes to contribute to the work. This also included any individual members of international, regional and national organizations. Over 25 eminent speakers presented and discussed during the sessions. Details about the [agenda](#) and speakers as well as all presentations delivered, can be found on the event's website¹. Overall, 350 participants (with close to almost 500 registrations) from all over the world joined this workshop, which was held virtually using "Zoom Webinar" as remote participation tool.

¹ <http://itu.int/go/64BK>

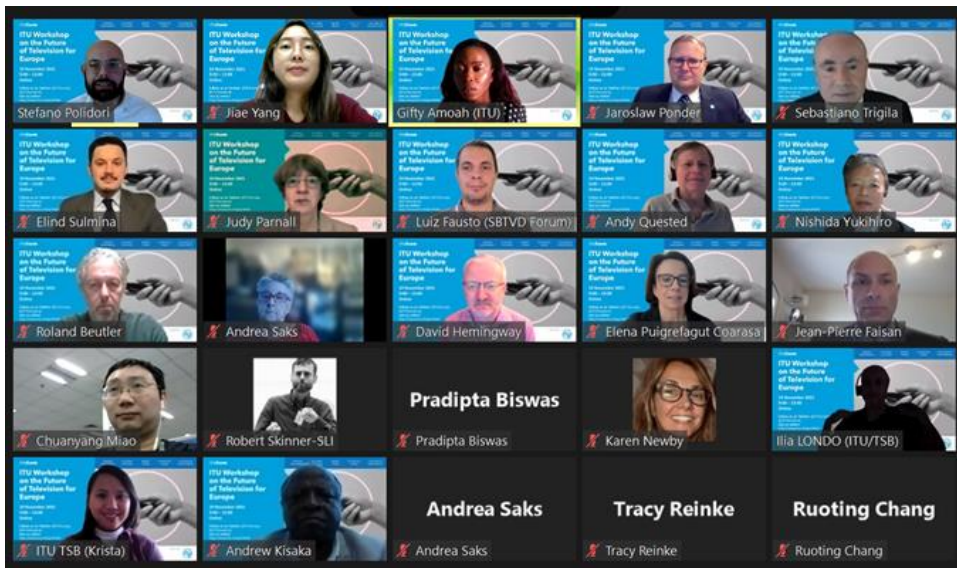


Figure 1 - Virtual Group Photo

3. DOCUMENTATION

The Regional workshop was held virtually. Relevant documentation, was made available in electronic form on the event webpage: <http://itu.int/go/64BK>

4. OPENING SEGMENT

In his opening speech, **Dr Chaesub Lee**, Director, Telecommunication Standardization Bureau, ITU, welcomed all the participants and representatives of regulatory authorities, industry, and research by recalling the crucial role that television has played in keeping the world informed and connected. He also highlighted that ITU is a key figure in the TV's history, and ITU will also play an equally important part in shaping its future. Currently, around 485,000 broadcasting TV and sound frequency registrations are mandated by ITU. Dr Lee showed his expectations on gaining fresh insight on the latest advances at the intersection of AI, immersive media and personalized services, looking at how these advances will change the way we experience business, health, education, and entertainment, as well as how they will change the way people with disabilities experience daily life. Focusing on the envisions of the European countries, Dr Lee mentioned that the workshop will contribute to shaping how ITU can assist each stakeholder in the European region in achieving these ambitious goals. Finally, he particularly thanked the European Broadcasting Union for their strong support in designing the program, as well as speakers and moderators and all participants for their contributions to the discussions during the workshop.

5. WORKSHOP SESSIONS

SESSION 1: NATIONAL AND EUROPEAN PLANS FOR TELEVISION

Focus: This session will discuss the importance of television policy and standardization as effective tools in the hands of regulators. Spectrum management and standardization roadmaps are in the

spotlight of Governments seeking to improve the quality of television services. Recent social trends, associated with renewed television platforms and related service offering, present challenges and opportunities for European authorities, as well as the ITU, in the roll-out of television over any media: cable, satellite and over-the-air.

Moderator: Mr Jaroslaw Ponder, Head of the ITU Office for Europe, ITU

Panellists: **Dr Jenny Weinand**, Senior Legal Counsel, EBU [[Presentation](#)], **Mr Sebastiano Trigila**, Research Group Leader, FUB Italy & Vicepresident Vicar, HD Forum Italia [[Presentation](#)], **Mr David Hemingway**, Chair of Spectrum Group, EBU [[Presentation](#)], **Ms Elena Puigrefagut Coarasa**, Senior Project Manager, EBU [[Presentation](#)], and **Dr Andrew Kisaka**, Vice-Chairman ITU-R Study Group 6 | Head of Licensing, Tanzania Communications Regulatory Authority (TCRA) [[Presentation](#)]

Key points:

“Future European regulations and media policy”: **Dr Jenny Weinand**, Senior Legal Counsel, EBU

- The European Union (EU) has taken action to remove obstacles to the free flow and cross-border circulation of services, driven by economic liberalization
- The first EU directive in this field is Television without Frontiers Directive from 1989. Through consecutive reforms, this directive is amended and broadened to the new directive, Audiovisual Media Services Directive. Not only does it cover broadcasting in the traditional sense, but it also sets out rules for on-demand services, advertising, protection of minors, promotion of European works, content standards, and video sharing platforms since 2018.
- Other EU law also covers the areas such as e-commerce, data protection, platform-to-business or business-to-business relationships, electronic communications, spectrum, accessibility and copyright. EU also have other soft law instruments that have been developed alongside these more binding legal rules such as the Code of conduct on countering hate speech (2016) and the Code of conduct on disinformation (2018).
- The fundamental rights dimension has recently been added to the style and types of EU regulations and legal instruments. Historically, EU laws have driven market liberalization from an economic perspective, but the fundamental rights dimension has recently been added to the style and types of EU regulations and legal instruments.
- Dr Weinand introduced the current two initiatives, Digital Services Act (DSA) and Digital Markets Act (DMA) of which negotiations are still ongoing at the EU level. The overall objective of such initiatives is to create a safer digital space protecting fundamental rights and to establish a fair platform for businesses.
- Dr Weinand added that the EU is slowly moving away from economic-based media to regulations considering fundamental rights and the cultural perspective which is underlined by the promotion of media freedom, media pluralism and media independence.

“Evolution scenarios for future television in Italy”: **Mr Sebastiano Trigila**, Research Group Leader, FUB Italy & Vicepresident Vicar, HD Forum Italia

- Today's television in Italy is divided between DTT, or TV satellite. DTT services are predominant in terms of the size of the audience, but OTT services have been receiving more audience.
- Italy is undergoing a transition from first generation (DVB-T) to second generation (DVB-T2). DVB-T2 uses 12 multiplexes with national coverage and HEVC. The reasons of this transition were to comply with the requirement of making the 700-megahertz band available for the mobile services, to enhance quantity and quality of current offer, and to match expected user experience with high quality of tv screens.
- One of the main challenges from the point of view of Mr Trigila is to allow broadcasters and users to afford the transition.
- Italy has implemented the following preparation and mitigation measures for users: i) foster introduction of enabled receivers by suitable laws; ii) count on natural changeover of TV sets; iii) subsidize receivers for enabled STB purchase and TV replacement; iv) monitor the installed basis of receivers and act consequently.

“Future spectrum challenges for terrestrial television broadcasting in Europe”: **Mr David Hemingway**, Chair of Spectrum Group, EBU & **Ms Elena Puigrefagut Coarasa**, Senior Project Manager, EBU

- Television delivery, Digital Terrestrial Television (DTT) will be part of the landscape for the foreseeable future and that does require spectrum.
- For terrestrial delivery, it is necessary to ensure that broadcasters have sufficient spectrum to deliver television for the foreseeable future and the spectrum challenges.
- One of the agenda of the world radio communication conferences in 2023(WRC-23) is looking at the current and future use of the Ultra High Frequency (UHF) band for 470 to 694 megahertz and the use of up to 960 megahertz and deciding if regulatory action is needed to reallocate parts of that spectrum for new uses.
- UHF spectrum is used for DTT broadcasting and Program Making and Special Events (PMSE), radio microphones, talk-back and so forth.
- DTT is evolving and moving into new technologies. However, different broadcasters and countries are evolving at different pace.
- One of the main findings of the ITU report BT.2302-1 is that a large majority of countries is expressing the need for 224 megahertz for broadcasting. Twelve countries in the Region 1 plus Iran indicated their interests in keeping more than 224 megahertz for broadcasting and seven countries in total demonstrated their needs for less than 224 megahertz in this band. Only two countries in Europe, namely Slovenia and Finland expressed their needs for less than 224 megahertz.
- The ITU report BT-2383 contains all the typical frequency sharing characteristics. The main findings from the questionnaire in this report are: The majority of countries in the Region 1 and Iran use DVB-T2, while 19% of the respondent countries still use DVB-T only; Some have moved entirely to DVB-T2 and some have a mixed economy of both DVB-I and 2T across Europe; Around 45% of administrations said they would be investigating additional reception

modes, compares with 26% who said they weren't and 29% who didn't know the answer to that question at this point.

- C-Band downlink offers extremely good performance to rain attenuation and a large geographic region. It is essential for EBU Members to distribute their international services. The main difficulties, however, are that sharing spectrum with mobile IMT services (e.g. 4G/5G) demands large separation distances (up to hundreds of km) to avoid interference to satellite services, and that receive-only satellite dishes are not necessarily registered.
- Many European countries have already auctioned the band, 3400-3800 MHz, for mobile broadband for the use of 5G. As a consequence, satellite services had to stop using that band due to technical incompatibility to share the spectrum with 5G. EBU members' use is now confined to upper parts of the downlink band, 3800-4200 MHz, but the European Commission is also considering the spectrum 3800-4200 MHz for 5G services. This is expected to be another challenge for broadcasters that rely on C band for the TV services. EBU works constantly with satellite operators and works towards cooperation in international regulatory forum to find solutions, for the use of C band.
- From the perspective of EBU, Ku Band is key for satellite Direct-To-Home (DTH) reception, contribution and distribution to head-ends for all EBU Members as well as for Eurovision services. Receive-only satellite dishes in Ku band are not necessarily registered so they cannot claim protection and are vulnerable to interference. Although the WRC-23 agenda item will not have a direct impact on the regulations, it could carry risk for the Ku band and EBU is in progress of monitoring.

"Trend of television delivery in East African Countries - Opportunities and challenges": **Dr Andrew Kisaka**, Vice-Chairman ITU-R Study Group 6 | Head of Licensing, Tanzania Communications Regulatory Authority (TCRA)

- Four East Africa Communication Organisation (EACO), namely Burundi, Kenya, Rwanda, Tanzania and Uganda, switched off analogue terrestrial television and moved to digital television before June 2015.
- Three types of television broadcasting content delivery of EACO are i) DTT broadcast-based content; ii) Internet based content; iii) cable television. The main television delivery platform for EACO is DTT broadcast-based content and DTH is used as an extension of DTT to complement coverage. Cable television is a platform for pay television and in most cases is available in rural areas with subscribers ranging from 50 – 1000.
- As of March 2021, there were 2,814,003 DTT and DTH decoders (1,341,686 of DTH decoders and 1,472,317 of DTT decoders). Cable television is still in small scale with around 100,000 cable decoders. Smartphone penetration is estimated to be 26% while Internet penetration is 49% (with 29,071,817 Internet users). Smart television receivers are growing slowly, but the exact data is not available.
- There are estimated number of viewers 13,225,814 for DTT, as of March 2021. The five Countries in EACO have adopted similar DTT value chain which comprises of Content Service Provider, Signal Distributor (SD) and Consumer.
- Dr Kisaka explained that one of the opportunities that EACO faces is diversity and pluralism of contents, especially through DTT. Another opportunity is to empower youth through local

subscription content. Youth generations are creating new content, which creates new employment and sources of revenues. Online-contents also allow more business opportunities.

- The price of DTT decoders ranges from USD 30-35 and that of DTH ranges from USD 40–50, which are unaffordable for lower income earners. Another challenge mentioned by Dr Kisaka is interoperability of Set Top boxes that consumers expect to have to smoothly move from one service provider to another service provider. With the increasing number of content services providers, content monitoring and regulating online media are arising as another challenge from the regulators' point of view.

SESSION 2: THE FUTURE USER EXPERIENCE FOR TELEVISION

Focus: The broadcasting industry is currently confronted with new market demands. The television industry is pursuing the use of AI-based technology to deliver more immersive content to its audience, over multi devices, in order to quickly adapt and meet the requirements of today's society. More personalized and accessible services as well as more immersive and tailored television experience is the key. This session will discuss the key projects, initiatives, and technologies being implemented in the Europe region.

Moderator: **Dr Hans Hoffmann**, Unit Head, Media Fundamentals and Production Technology, Technology and Development Department, EBU

Panellists: **Ms Judy Parnall**, Chair of Technical Committee, EBU [[Presentation](#)], **Mr Sebastien Noir**, Head of Software Engineering, Technology & Innovation, EBU [[Presentation](#)], **Dr Pilar Orero**, Professor, Universitat Autònoma de Barcelona, **Dr Pradipta Biswas**, Assistant professor, Centre for Product Design and Manufacturing & Robert Bosch Centre for Cyber Physical Systems [[Presentation](#)], and **Mr Luiz Fausto Souza Brito**, Technical Leader, SBTVD Forum [[Presentation](#)]

Key points:

"Future European user experience for television in Europe": **Ms Judy Parnall**, Chair of Technical Committee, EBU

- EBU explained that personalization and immersion are two important areas for the future of user experience
- The user may receive personalized contents suggestions based on a prediction by the service in the future TV market through more holistic broadcast and broadband delivery. A fully personalized user experience will require the personalized system as well to identify the user such as facial or voice recognition. It is necessary for public service broadcasters to consider the data security issue, surveillance mechanisms and regulations to launch such services.
- EBU expect to see significant growth in digital assistants and ambient computing ecosystems over the coming years. People are becoming more used to a casual and natural language interactions facilitated through voice and dynamic responses from the GUI (graphical user interface). Digital assistants evolve to function as companions.

- Ms Parnall explained that adaptive experiences are important for the new audiences. All users may be able to understand and enjoy any content with universal accessibility Having subtitles and Greater sense of reality.
- Ms Parnall added that users will be able to have more immersed experience with new devices and technologies such as an eyeglass integrated with head-mounted display (HMD) technology, portable 3D displays and 3D audio. Metaverse world was also mentioned as one of the new technologies that brings a greater sense of reality. AR Cloud and brain computer interfaces will also allow merging the physical and the virtual worlds in the future.
- Ms Parnall expected that Ultra-HD TV services from 4K to 8K, and possibly 16K may become available, as well as extended reality (XR) services and Next Generation Audio (NGA) services.

"Future Interactive user experience for television in Europe": **Mr Sebastien Noir**, Head of Software Engineering, Technology & Innovation, EBU

- Mr Noir explained that the borders of TV experiences are becoming unclear and blurry due to multiple screen devices and diversity of contents services.
- From the perspective of Mr Noir from EBU, the high quality of the production and the capture with higher resolution, more frames, more dynamic range, better audio, and being more immersive make good TV experiences.
- Entry barrier to become a TV producer has become low and the pandemic accelerated the trend of moving to remote production.
- It is more competitive to receive attention from TV users and make them stay due to numerous content producers from other platforms.
- Mr Noir pointed out that TV is becoming just an application to many users and broadcasters are becoming media, data or net companies.
- Serving the audience will mean creating a universe for each user regardless of the will of broadcasters to attract users. Personalisation and recommendation become the norm of TV services, and also a key to be competitive in the new contents market.

"Future accessibility for television in Europe": **Dr Pilar Orero**, Professor, Universitat Autònoma de Barcelona

- Dr Orero identified one of the issues of accessibility for television in Europe as lack of standardization on the symbol of accessibility services. A standardized icon for all Europeans regardless of their languages and an audio symbol for people with hearing disabilities are needed. ITU should put efforts in standardizing the accessibility services for Europe and beyond.
- Another opportunity arises with the trends that consumer becomes '**prosumers**'. It has become possible for consumers to also produce accessibility services remotely and sell them across Europe. This opens a new possibility of better accessibility in all different languages in Europe.

“Common User Profile over various media”: **Dr Pradipta Biswas**, Assistant professor, Centre for Product Design and Manufacturing & Robert Bosch Centre for Cyber Physical Systems

- Creating a common user profile format is to offer personalized service to people with different range of abilities by deploying with independent formats and adapting user interface parameters like font size, colour contrast, audio volume, arrangement of screen elements and so on.
- Common user profile format is currently addressed by at ITU-S Study Group 9 and 16, with input from Study Group 6.
- Any personal or any demographic information about user must not be stored on the server but only in the device of clients. It must strictly comply with the existing EU and other legislation. A mapping mechanism can be implemented to share only interface parameters, not the personal data.
- The main objective of creating common user profile format is to reduce the digital divide. It is important to share personalizing information and meta data in secure and platform in an independent way with an overall aim to conform to the UN CRPD.

“The future user experience requirements for television - Project TV3.0, a case study in Brazil”: **Mr Luiz Fausto Souza Brito**, Technical Leader, SBTVD Forum

- Free-to-Air terrestrial broadcasting is the main TV distribution platform in Brazil, having around 70% of Brazilian households as users. Brazil completed the terrestrial digital switchover in all metropolitan areas, and it will be completed in the rural area as well by 2023. Currently, digital terrestrial television shares more than 80% of the terrestrial television, growing every year. The overall terrestrial television share is also increasing.
- Brazil is working on the next generation DTT system, called TV 3.0, which is app-based TV, not channel based.
- For TV 3.0, it is important that the content can adapt to preferences, environment, geographical location, and different ranges of ability of users. It is equally crucial that the contents are available in any device at any time.
- Seamless and transparent integration between linear and non-linear content are vital and popular live event transmissions should not use unicast distribution, not limited by network congestion.
- Brazil is currently working on a new concept of having a frequency to have a very robust transition, which will allow to reuse the same channel in all stations to transmit the same content to indoor fixed reception and outdoor mobile reception.

SESSION 3: THE FUTURE CONTENT CREATION FOR TELEVISION

Focus: This session will present current and future trends in collaborative content creation technologies for Television over the various media, including cloud-based and IP-based production that increases production flexibility. An increased use of 5G for production will also be discussed.

Moderator: Ms Susanne Rath, Senior Engineer, Bayerischer Rundfunk ARD CCFM

Speaker: Dr Khishigbayar Dushchuluun, Senior Research Leader, ARD CCFM Competence Center International Frequency Management [[Presentation](#)], Mr Andy Quested, Chair, ITU-R WP 6C [[Presentation](#)], and Mr Ievgen Kostiukevych, Team Leader, Media over IP and Cloud Technologies, EBU [[Presentation](#)]

Key points:

“Using 5G campus networks for television production”: Dr Khishigbayar Dushchuluun, Senior Research Leader, ARD CCFM Competence Center International Frequency Management

- From the ARD CCFM Competence Center, Dr Duschuluun defined 5G as the Next Generation fibre technology, with new leaping forward metrics in speed and latency, 5G is expected to drive innovation and open new business opportunities.
- The Broadcasters are looking forward to the large-scale deployment of 5G, because: i) it improves the technical & operational efficiency while increase flexibility and ease of its implementation; ii) it reduces production cost associated with it; iii) it guarantees performance characteristics in terms of data rate, low latency and (QoS); iv) it enables new production tv workflows with best quality and maximum security.
- Dr Duschuluun defined 5G campus network as a standalone network which is deployed completely separated from a public network and can cover a small geographical area (from a few hundred square meters indoor to few kilometres outdoor) which gives internet access only to devices that are related with the campus.
- By doing so, it improves security and allows for full flexibility and customization from the campus network operators according to the needs. The costs associated with are then given by providing with the example of the 5G campus network and relative spectrum fees in Germany.
- The technical improvements are highlighted, which 5G allows for, such as the transmission for live views from up to 4 fully synchronized HD professional camera together with one 4K-quality camera, all of which are connected through HDMI to SDI to the transmission unit. Then the signals are transmitted to the 5G Media Broadcast Campus server that is then transmitted to the internet.
- The 5G Campus network provides with: i) High bandwidth, with no load on the bandwidth due to external interference; ii) High-security level, for private industrial frequency on premises; iii) Provider-independency, by reaching application area everywhere, where an own frequency spectrum from 3.7 GHz to 3.8 GHz is available; iv) Mobile use everywhere, as some solutions can result in small and compact products that can be packed in a flight case 80x120x100cm.

- 5G is beneficial from the perspective of Dr Dushchuluun because: i) it can be used to improve technical and operational efficiency, increase flexibility, and reduce production cost; ii) it can be used to enable new production workflows, particularly in remote production, news gathering, coverage of live events and user engagement; iii) it can open new possibilities in fields different from media production.

“Advanced immersive sensory media production”: **Mr Andy Quested**, Chair of ITU-R Working Party 6C, CO-Chair ITU Joint Sector Accessibility Group

- In two ITU-R reports published, namely ITU-R BT.2447 (Artificial intelligence systems for program production and exchange) and ITU-R BT.2420 (Collection of Usage scenarios and current statuses of advanced immersive sensory media systems), new trials and current pilots are explored in the domain of: i) Immersive audio; ii) Haptic enhanced content; iii) Text to speech/Speech to text; iv) AI generated presenters; v) Signing language & translation; vi) Automated speech & caption translation; vii) Automated text to audio-description; viii) AI aspect ratio & screen shape adaption; ix) Object Media
- Mr Quested explained that the four categories Personal Media and accessibility, hear – see – interact – understand, are not completely independent from one another, but are rather interrelated. One other element that was presented was the role played by the object media, as now objects can deliver the content as it is needed by the users.
- Taking the example of audio, Mr Quested presented how media production is started to be rethought by some in order to make it both personalized as well as accessible. With the new approach, audio can now be reprocessed by following the AISM Process, focusing on Essence Layer (Object/Accessible oriented narrative); Objects Layer (vision, sound, data...); Options Layer and Control Layer (Common User Profile, device and platform transferable data). All this results in the program maker, or the creator of the content, and is used to get the best possible quality of experience (not to be misunderstood with the quality of service).
- Mr Quested also presented the case of the Metahuman evolution, with the beginning of the merging of games, technology and tv, the common user profile - and how data can be sent by the program maker to fit the screen independently of the hardware (TV, immersive device or mobile device) and finally to the immersive experience and virtual space, that can only be made available thanks to the use of technology applied not just to program making but program viewing as well.
- Some examples of different technologies being used in different contexts are introduced as well during the presentation, such as the case of the googles that help people with vision impairment (<https://www.bbc.co.uk/news/av/uk-england-hereford-worcester-48806835>) or the fashion that allows to feel music (<https://youtu.be/6xUAGuq2sBk>)

“Hybrid Cloud Live Production”: **Mr Ievgen Kostiukevych**, Team Leader, Media over IP and Cloud Technologies, EBU

- COVID-19 has pushed media organizations to embrace the cloud, also for live. Cloud is one of the technological enablers of digital transformation.

- Cloud allows to build all the new capabilities benefitting the tv broadcasting services. Cloud is used by everyone to archive documents and files, but now media organizations are now embracing live broadcasting.
- Mr Kostiukevych pointed out at the traditional methods of broadcasting services (some content is produced, encoded and sent by using the public internet or a dedicated circuit to a broadcasting facility) are now challenged by the adoption of 5G and by the use of the cloud, as it now allows to fully replicate the broadcasting facility in one single place. With Cloud, it is now possible to build all sorts of workflows on demand. In other words, Cloud is one of the technological enablers of digital transformation. But it is not just about technology, the audience consumes content, not technology.
- The cost of ownership is also highlighted. These new types of smaller and agile broadcaster can only exist as the cloud is becoming more accessible.

SESSION 4: THE FUTURE CONTENT DELIVERY FOR TELEVISION

Focus: This session will focus on the delivery of television content to end users. The future delivery of television will be a mixed environment, where broadcasting, broadband, including IP-based and cable TV, combine to provide media services. Related challenges, including “5G broadcast” and collaborative networks, provide potential opportunities.

Moderator: **Dr Yukihiro Nishida**, Chairman, ITU-R Study Group 6, NHK, Tokyo, Japan

Panellists: **Mr Jean-Pierre Faisan**, Chair, Communications Working Group, Broadcast Network Europe [[Presentation](#)], **Mr Chuanyang Miao**, Associate Rapporteur Q13/SG16, ZTE [[Presentation](#)], **Dr Curtis Knittle**, VP Wired Technologies, R&D, CableLabs [[Presentation](#)], **Mr Nick Stubbs**, Vice President Western Europe, SES [[Presentation](#)], **Dr Roland Beutler**, Technology and Production Directorate, Program Distribution Strategy, SWR [[Presentation](#)] and **Mr Aziz Taga**, Product Owner/Head of Business development 5G Media Services, Rohde & Schwarz

Key Points:

“Future proof terrestrial TV broadcasting networks”: **Mr Jean-Pierre Faisan**, Chair, Communications Working Group, Broadcast Network Europe

- Mr. Faisan mentioned that it is important to secure to 250 million European viewers universal access to the TV, radio and over the-air services that they watch and enjoy regularly.
- Broadcast Networks Europe (BNE) represents Europe's terrestrial network operators in Europe and internationally. BNE is a transmission facility provider, i.e BNE invests in transmission towers and facilities.
- BNE members are European long-term investors and operators of broadcasting networks for DTT, radio and associated services. BNE’s customers are public service and commercial leading companies such as National, regional and local broadcasters and content providers (live and online TV and radio).
- Digital Terrestrial Television (DTT) is the primary source of trusted information and quality content for European citizens. Some key numbers show that:
 - On average, people spend 3 hours and 34 minutes of TV per day.

- 90% of that is consumed live.
- There are 100 million households in Europe that have access to DTT as it remains #1 distribution platform for linear TV in Europe (in penetration).
- DTT ensures universal, free and reliable access to free TV, news and entertainment. Critical role for society resiliency during the pandemics.
- In an era of online disinformation, DTT is an essential source of impartial and quality information.
- DTT and broadcasting consumption remain anonymous and respect privacy.
- The European audio-visual sector is strategic for the Union and terrestrial broadcasting is its backbone.
- From the perspective of Mr Faisan, the future of tv will result in: i) Higher quality (enhanced HD, UHD TV, improved sound, interactivity with HbbTV); ii) DTT and OTT are complementary- DTT for live TV viewing, hybrid TV through OTT for nonlinear; iii) DTT and 5G are complementary- DTT at home, 5G Broadcast on the move.
- One other element is emphasized related to the environmental aspects that DTT remains a sustainable platform compared to the new broadcasting forms. He pointed out at the Carnstone for LoCat (The Low Carbon TV delivery Project) findings which proves that the least consuming means among DTT, OTT and IP-delivered methods is still DTT, all along the whole TV chain. The second finding proved that this pattern is present across all European countries. Third and last finding points out that this pattern will remain the same in the long term under certain scenarios.
- The vital importance UHF spectrum plays as a resource to operate, innovate and compete. The key elements are: i) DTT uses the state-of-the-art spectrum-efficient compression and transmission technologies, while sharing the band with PMSE, Radio Astronomy and others; ii) European broadcasters can only continue to innovate and compete if they have the full access to the 470-694 MHz band, paving the way to HD and UHD; iii) European Parliament, Council and the Commission have secured long term access to spectrum for terrestrial broadcasting, by law until at least 2030; iv) DTT licenses in the UK have been extended to 2034. France's new law paves the way for the introduction of UHD. The new German Alliance for Broadcasting and Cultural Frequencies has been created; v) ITU-R Report BT 2302-01 provides information on Spectrum requirements for terrestrial television broadcasting in the UHF frequency band in Region1; vi) The position of BNE, regarding international discussions on the agenda of WRC-23 is in favour of NO CHANGE to the Region 1 allocation in the 470-694 MHz band.
- Mr Faisan suggested the three main keys for future proof terrestrial broadcasting networks: i) The Terrestrial broadcasting roadmap combines an increase of quality, linear TV and non-linear in hybrid mode, and access to mobile terminals; ii) The European UHF Decision identifies 470-694 MHz as the core spectrum for terrestrial broadcasting and PMSE, for the long term; iii) Ensuring environmentally friendly and universal access to Free Television, news and entertainment; bringing business, social, cultural and sovereignty benefits to Europe.

“The future IP-based delivery for television, including OTT and IPTV”: **Mr Chuanyang Miao**, Associate Rapporteur Q13/SG16, ZTE.

- The data on main Chinese telecommunication operators' revenue in 2020 show that i) Traffic operation revenues have become the largest proportion of operators' revenues, especially video service; ii) Due to the lack of support from market and new services, it is difficult for conventional TV services to attract new users; iii) The consumption of mobile traffic is increasing rapidly. “live broadcast +” service covers diverse industries.
- End users have strong mobile service requirements and “video + service” will become mainstreams. Moreover, Communication Operators are currently in control of the many basic natural resources, but inefficient usage + with enclosed service capability will result in difficulties to reduce operational costs. Mr Miao then questioned how everyone can benefit from this service channel. For him, one possible way is that the infrastructure networks hosted by the communication operators will be open to OTT, hence allowing it to open service capability to reduce traffic resource occupation and improve the unsafe of network resource.
- From the point of view of Mr Miao, the future of the content delivery innovation (CDN) should be mapped with the key features (ultra-low latency, ultra-high bandwidth, massive connection, Mobility, Open resource/capability, Converged Services).
- 5G can be seen as part of the opportunities, though it also presents a series of challenges. Examples are given for Ubiquitous video application (video+edu, video+health, video+tour); traffic burst and tidal effect (pop drama, live sport, holiday); and ultra-high broadband demand with the development of ultra-HD Industry (8k live broadcasting, VR, Free viewpoint tv).
- The traditional waterfall scheme cannot meet the CDN requirements. To overcome that, Multilayer distribution technology of the content can be realized so through the intelligence of distribution system, 5G CDN can distribute the content of each network layer. Moreover, by taking advantage of the motivation and container technology of virtualized CDN. MEC-CDN: Network + Computing + Application is the perfect example of the virtualized and the container technology. The Interactive living broadcast, the ultra-low latency real-time multicast broadcast, is also introduced.

“Future of cable television delivery in Europe”: **Dr Curtis Knittle**, VP Wired Technologies, R&D, CableLabs.

- Data on the current trends on the fundamental change to video business show that i) Traditional multi-channel video delivery will become a minority compared to virtual and online delivery formats; ii) Such new formats have profound impact on content creation and distribution ecosystem; iii) With the exception of OTA, all other segments are migrating to IP distribution.
- Dr Knittle summarized fundamental changes of video business as: On the service side, cable operators are adjusting to support delivery-agnostic content aggregation and OTT distribution - Support traditional cable delivery - Host apps like Netflix, Youtube, Prime, etc. On the network side, cable operators will evolve network capacity to support future broadband subscriber requirements.

- Dr Knittle presented the capacity roadmap for the cable industry, divided by coaxial cable and fiber optic primarily, which uses the Docsis protocol and the passive optica network (PON). Today most operators use Docsis 3.1, with the next being Docsis 4.0 that allows for 10 gigabit per seconds in downstream and up to 6 gigabits per second upstream. The next-Gen Docsis aims at reaching up to 25 gigabits per second in download stream. In relation to PON, fiber-to-the-home (FTTH) services is delivered today with 10 G PON. Finally Coherent PON (CPON) is expected to DS 100G and US up to 100G.
- For what pertains to DOCSIS 4.0, and as more spectrum means more capacity, Dr Knittle elaborated on how cable networks provide symmetric capacity. Especially thanks to Docsis 4.0 the primary objective has been to maintain the same amount of downstream spectrum and therefore downstream capacity, at the same time, extend the amount of upstream spectrum and the upstream capacity as well. Both modes of operation and Docsis 4.0 will be capable of delivering multi gigabit symmetric services, keeping the hybrid fiber coaxial solutions on par with present 10 giga PON.
- Coherent PON, an optical transmission technology used in long haul networks, was also presented by Dr Knittle. Usually, traditional PONs use intensity modulation with direct detected, but with Coherent PON it is possible to increase capacity by a factor of 10 relative to today's deployed PON which is 10 Giga. This technology will be capable of going 4 times further.
- Dr Knittle highlighted that more capacity will be needed as HD is moving to 4k and even to 8k. The cable industry is currently working towards the support of that higher capacity in the future video delivery.

“Future of satellite television delivery in Europe”: **Mr Nick Stubbs**, Vice President Western Europe, SES

- Mr Stubbs identified a number of trends in the future of TV: i) Increased on-demand streaming, particularly a significant increase in fibre-to-the-home in the developed world as well as TVs with built-in smart connectivity; ii) Increased viewing on the move (steady roll-out of 5G in urban areas); iii) Increased adoption of 4K UHD in the home; iv) Emergence of global platform operators; v) Increased adoption of targeted advertising; vi) Increased use of AI-based personal content scheduling; vii) Increasing trend towards AVOD from SVOD with increased availability of free-of-subscription options based on personalised advertising insertion into content).
- Satellite market has grown since 2016 up to 40 % and is now stable in Europe. Moreover, satellites are also necessary for linear tv distribution, which has remained robust over the course of the years. Concerning broadcast tv, the use of satellite is a very cost effective and robust way to deliver linear tv. Furthermore, DVBI and 5G are parts of the movement towards all IP Distribution; and the satellite industry is ready to embrace it.
- The role of satellite in the broadcast television in the future : i) Broadcast via satellite will be around a long time – it is highly resilient and very cost effective; ii) Expect to see continued adoption of 4k/8k TV sets and greater demand for bandwidth for UHD content especially in sports; iii) Movement towards all IP content distribution; iv) Increased use of satellite for multi-cast content delivery at the edge and cellular backhaul to connect bandwidth demanding remote communities; v) Continued combination of linear and on-demand viewing;

vi) Increased viewing on multi-devices and on the move as 5G networks footprints increase and NGSO constellations are deployed; vii) Increase use of AI and ML for targeted advertising and viewing.

“5G Broadcast for the Distribution of Public Service Media (PSM) Content and Services”: **Dr Roland Beutler**, Technology and Production Directorate, Program Distribution Strategy, SWR.

- From a public service broadcasting perspective, smartphones and tablets are strategic targets for all our content services, not just for on-demand services. Moreover, cars and autonomous driving systems will result in a different use case of the car: from more spare time to a 360 degrees head-up display; to geo-referenced recommendations, to travel-related services. The 3GPP has published a study on “*3rd Generation Partnership Project: Technical Specification Group Services and System Aspects: 3GPP Enhancement for TV Service Release*”.
- The PSM requirements are presented: i) Predictable and Sustained QoS; ii) Flexible Use of Network Capacity (incl. 100% broadcast); iii) Large Coverage Areas; iv) Free2Air Reception (SIM- free, Receive-Only); v) Standalone eMBMS Network; vi) Mixed Unicast / Broadcast Use (Shared Network); vii) Fixed and Mobile Reception
- 5G Broadcasting is no replacement of DVB-T2 for stationary reception and targets smartphones, tables and vehicles. 5G Broadcast can also carry both linear TV and radio programmes
- Simultaneous usage of 5G and 5G Broadcast may unlock new, innovative use cases and business opportunities.

“5G Broadcast - The point of view of a vendor”: **Mr Mohamed Aziz Taga**, Product Owner/Head of Business development 5G Media Services, Rohde & Schwarz

- As a broadcasting leading vendor from a broadcasting market perspective, it is very crucial for Rohde & Schwarz to shape the future of the broadcasting industry.
- Understanding when a technology becomes obsolete and looking into what future technology could be fit for purpose and complement the current existing ones.
- Important to create a central approach between telco world and broadcast world, since 5G broadcasting is a combination of those.
- Important to design new ideas around business incentives and to push for short-time-to market. This can be achieved by reoptimizing the broadcast resource allocation and usage.
- Since early 5G release, it has addressed many verticals, among which broadcast and media.
- 5G broadcast is ready for prime time in terms of commercial deployment but requires an end-to-end solution from the vendor perspective – basing it on the current market needs and requirements.
- From a regulatory perspective, WRC23 will play a very important role in relation to 5G broadcasting.

6. CLOSING REMARKS

Mr Ponder gave the closing remarks. In his closing remarks, He thanked all partners, the members of the Program Committee, the HQ Secretariat and everyone involved in the preparation. Mr Ponder extended his thanks to the moderators and panellists for their valuable contributions for the success of this event as well as to the audience for participation. He then summarized the key takeaways of the event and drew the attention towards the upcoming ITU global conferences in 2022, mainly the World Telecommunication Standardization Assembly, the World Telecommunication Development Conference and the Plenipotentiary Conference in October 2022.

Finally, **Mr Polidori** extended his thanks to Mr Ponder, to the ITU Office for Europe for coordination as well as to the Program Committee for designing the Event, and to the Director of TSB for his opening remarks. He then invited the audience to participate in the next regional workshop on the future of television that will be co-organized after the WTSA-20 together with the ITU Regional Offices. Mr Polidori hoped that next event could target the African region in 2022 or 2023.