PR(O)DUCTION TECHNOLOGY
SEMINAR
AN EBU EVENT
NAVIGATING MEDIA CREATION IN THE CLOUD

# PRODUCTION TECHNOLOGY SEMINAR 2021 EVENT SUMMARY

26–28 January 2021

Presentations and videos:
https://tech.ebu.ch/pts2021

Disclaimer: This report is intended as a quick overview of the event. Before quoting any of the speakers we recommend that you refer to the original presentation and check with the speakers themselves.

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# 1: KEYNOTE SESSION

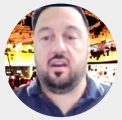


## Welcome & Introduction

Antonio Arcidiacono (EBU)

The motto for this event is “navigating content creation in the cloud”. It is apt, as we have been through a stormy year, including for the media industry. When a storm hits, sailors must work together – this is the moment we must work together if we want to reach the harbour. “*Working and building together has been always fundamental in media and it is even more important today*.”

We have seen an overnight acceleration in remote production triggered by the COVID-19 crisis; this acceleration, combined with the evolution of 5G technologies for production, promises to further revolutionize the way in which event production will evolve opening a new space for storytelling.



## AI for bias detection in news

Grant Totten (Al Jazeera), Preslav Nakov (QCRI)

Building on their work on metadata enrichment and the addition of contextual metadata, Al Jazeera has been applying various techniques on top, one of which is bias detection. They’ve defined various types of bias and can detect them at the level of an individual document or programme, or over a period of time.

The system can take text, including transcribed from a video, and analyse what has been said and how it has been said. Bias detection is done on the basis of three or seven point scales (left-centre-right). The models used have been exposed via APIs.

Extension to image-based analysis is foreseen.

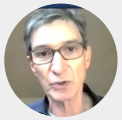
## Think cloud first

Cristina Gomila (Sky)

Sky has a capability map that shows all of the tasks that are involved in getting content to the customers – and the aim now is to migrate as many of them as possible to the cloud.

They have provided a framework to guide developers: they should think cloud by default, or at least be cloud-friendly; work with the content wherever it originates; and avoid the vendor lock-in that happened in the hardware world. They’ve developed a virtual production suite and are migrating playout, VOD and aspects of live production to the cloud.

“*You have to build a transformation programme in which your own workforce massively embraces cloud.*”



## Why 2021 will be the most disruptive year yet for the media industry

Mark Harrison (DPP)

DPP’s predications for 2021, representing the whole media supply chain, are that the workplace will be redefined, that market disruption and consolidation will be widespread, and that unpredictability will be the new normal. “*It’s a picture of immense turbulence*.”

Additionally, and mirroring other industries, AI and automation will become pervasive across the entire supply chain, including in production. This is going to preoccupy both individuals and companies in our industry as they grapple with the need to meet consumer demand, to deal with economic turbulence, and to implement the kind of technology that we need in order to meet those goals.

# 2: USER STORIES

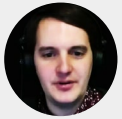
## Cardiff Central Square – experiences after going Live IP

Roger Crothers (BBC)

Ten years in the making and now just about complete, the BBC's first IP broadcast centre is based around a SMPTE ST 2110 IP core. They used a variety of suppliers rather than a single vendor. It makes interop more difficult but they have ended up with the best individual products. The challenge is making them work together.

Complexity is probably the biggest issue to this day. It's difficult troubleshooting faults when they appear – engineers don't always know where to begin and need to go back to vendors more often than expected.

The biggest single change is the need to be constantly on top of the infrastructure – it needs to be patched and upgraded regularly.

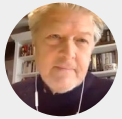


## Flexible workflow learnings from Control Room 42

Hugo Ortiz (RTBF)

Control Room 42 is a prototype of a vision that will see RTBF (with its new HQ to open in 2024) move from a typical equipment-defined control room to a more flexible universal control room. The aim is to abstract (and often even supress) the notion of equipment behind a universal user interface that can be reconfigured through the day according to the needs of radio and TV productions.

Technically there are three layers: the user-facing interface layer, a logic and integration layer, and behind that all the processing cores and software that are abstracted from the user. With a project like this it is crucial to work directly with users from Day 1. The technical challenges are small compared to the human change management challenge.



## A review of 2020 IBC Accelerator Media Innovation Projects

Muki Kulhan and Mark Smith (IBC)

IBC runs this framework to foster agile innovation for the media entertainment ecosystem. Each of the eight innovation projects delivered in 2020 had several organizations as champions and participants.

Highlights included an AI-driven UGG-based music talent show, championed by Warner Music and ViacomCBS, with ethical, responsible use of AI to the fore; a proof-of-concept of TV delivered as objects, championed by ITV, BBC, Unity Technologies, Yle and TV2, which delivered a prototype to demonstrate how TV can be personalized and delivered over IP; and an ambitious 5G remote production championed by BBC and many other broadcasters.

## Digital assistants' impact on media creation

Chris Dix (BBC)

There is increasing use of digital assistants, with interactivity ranging from very simple requests for a news update potentially up to highly complex social dialogue.

Content ideally needs to be responsive and react to its surroundings – time of day, location, device capabilities. The content also needs to adapt to the device itself – 'polymorphic content' that is truly adaptive to its environment can take voice capabilities beyond the smart speaker.

Discoverability is key: users shouldn't need to learn a specific vocabulary to talk to the digital assistant. The feedback from how users interact with devices is hugely valuable, but should be classified as personal data and treated as such.

# 3: THE BIG CLOUD DEBATE


## Setting the Scene

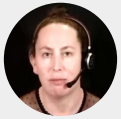
Conrad Gouws (RTÉ), Markus Ostertag (SWR)

Use of the cloud should be about how we can improve the way we produce and improve what we deliver to our audience. But it took a pandemic to look at the cloud seriously. The collaboration that quickly began has developed in the Hybrid and Cloud Production group that now meets biweekly. The kick-off survey identified live video as the top priority, so this has been the focus so far. Next on the list were post-production, playout, and producing from home or multiple locations.

The group has fostered a PoC at the IBU Biathlon, with a minimal on-site presence: six cameras feeding signals into the cloud, and operated by two separate production teams abroad.

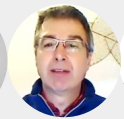
### Visions of how media should be produced in the cloud – presentations from four providers


Hanno Basse (Microsoft)


Claire Southey (AWS)


Rich Hastie (Nvidia)


Buzz Hays (Google)


## The Big Cloud Debate – User Panel

Conrad Gouws (RTÉ), Markus Ostertag (SWR), Willem Vermost (VRT)

***MO***: Moving to the cloud itself won't lead to new audiences, but it will help to work faster and to more **quickly launch new products and channels**…so it's more of an accelerator.

***WV***: From an operational point of view, it's really interesting that you can **reduce greatly the footprint**, and therefore the cost, of a production. The setup time goes down to zero.

***CG***: RTÉ's financial planning **isn't really set up to handle open-ended opex spending**, which is what we need for cloud.

***MO***: There is a **risk of vendor lock-in**. Ideally we should be able to choose an app or service and run them either on prem or on our preferred cloud platform. We might be forced to make compromises – we need standardized APIs across cloud providers.

***CG***: The procurement process is the place to **ask questions about sustainability** and carbon footprints – every tech procurement at RTÉ now includes questions about sustainability, with a 5% weighting applied. Use your procurement process for good!

***MO***: For disaster recovery purposes, having a copy of your archives in an external cloud makes sense. But if you're using it as a repository for production purposes and you want to avoid traffic latency it's **currently better to keep it on site**. Otherwise we have to think about moving all operations into the cloud and stay in the cloud.

***WV***: Technology teams need to switch gear **from 'supporting boxes' into 'workflow heroes'**, to build things that get to the audience by the end of the day.

# 3: THE BIG CLOUD DEBATE (II)

## Deploying technology – why choose standards?

Bruce Devlin (SMPTE)

Standards can help the industry as a whole achieve more. Deploying technology at scale is difficult and eventually you need to get the "big gorillas" to agree on something – to find compromises so that there are the necessary interfaces between systems. It could be the data interchange language or the descriptive languages, standardized API calls or data models. In the end we grow the whole model.

If you standardize *just enough* you make the whole market bigger for all the vendors. But if you don't standardize enough you never quite reach critical mass that allows you to put agile apps on top of stable interoperable platforms.

SMPTE is adopting its processes to make the standardization process itself more agile.

## Federated digital infrastructure – GAIA-X

Jesse Robbers (TNO)

Five non-European companies own 75% of the global cloud market. Discussions within Europe led to the June 2020 launch of GAIA-X, initially by a group of French and German companies but now setting up as a foundation in Belgium. 160 companies have signed up. It's about data sovereignty, and building up modular blocks, standards, and open source environments.

GAIA-X will not be an alternative cloud – it will be a way of working, of how you can build up a cloud and its applications and tools without lock-in or uncertainty about where the data is and what's being done with it.

Media isn't defined yet as an ecosystem within GAIA-X – we need to take action to ensure this happens.

## Security in the cloud – do we have to worry?

Lucille Verbaere (EBU)

While an EBU survey of Chief Information Security Officers highlighted cloud security as the highest concern, the survey by the Hybrid and Cloud Production group did not rate it as a priority. This gap is worrying.

Cloud security is a shared responsibility, with the cloud vendor responsible for the infrastructure while the users – the media companies – are responsible for all that relates to access and applications, as well as the end-to-end security of content. The tools are available, but they need to be properly applied and configured.

The EBU MCS group has created recommendations on implementing cloud security (R 146) and on cybersecurity safeguards for media vendor software and services (R 143).

## Summary and next steps for the EBU

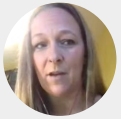
Ievgen Kostiukevych (EBU)

We have cloud vendors on one side and us as the users on the other, but we shouldn't see ourselves as enemies. There are important questions that were raised during our discussions: do we have enough trust in cross-cloud, multi-cloud approaches yet? Are we ready to take a risk and dive head-first into one implementation vs another?

The answers will come via dialogue. We need to rely on standardization, initiatives like GAIA-X or the VSF Ground-Cloud-Cloud-Ground (GCCG) project, and groups like EBU Media Cybersecurity to help us answer these questions. We need to keep the dialogue going with all the vendors and all the building blocks to ensure we create and ecosystem that will work for everyone.

# 4: KEYNOTE; 5: TUTORIAL





## The importance of diverse talent

Carrie Wootten (Rise)

Lots of research has been done into how diversity impacts businesses. As well as it being morally right to ensure gender diversity, the business case is clear: companies with a healthy balance of men and women are 21% more likely to outperform their competitors and gender diverse companies are 45% more likely to improve market share.

The Rise/IABM survey in 2020 found that men are more likely to occupy C-level positions in the industry and women tended to have lower salaries, given equal age.

Rise undertakes mentoring, runs workshops for schools and has an awards programme to highlight female talent. "*We need to inspire, we need to educate and we need to inform.*"

## Tutorial: Hands-on NGA production with the EAR Production Suite

Michael Weitnauer (IRT); Chris Pike (BBC)

NGA – Next Generation Audio – is a family of new audio technologies that will improve the audience experience by **making content more accessible, personalizable, adaptable and immersive**. Three codecs have been standardized for NGA: Dolby AC-4, MPEG-H Audio and DTS-UHD Audio.

The EBU has focused on promoting codec-agnostic standards for the production, exchange and archive of NGA: the Audio Definition Model (ADM) is a **standardized metadata model that can describe NGA content and formats**. An ADM production can be translated into the different NGA delivery formats. Find guidelines for its use at: adm.ebu.io

The next step was to develop the standardized EBU ADM Renderer (EAR) to convert NGA content into loudspeaker signals for listening. It is aligned with the consumer systems.

The EAR Production Suite provides **a set of tools for producing NGA**, consisting of VST plug-ins (input, control and monitoring) and an extension to the Reaper digital audio workstation (DAW). The intention is to demonstrate the intended use of ADM within DAWs and encourage its adoption.

A more detailed demo is available: ear-production-suite.ebu.io

The code is open source: github.com/ebu/ear-production-suite

# 6: SUSTAINABILITY

## Sustainability targets and progress within Daytime

Tim Guilder (ITV)

ITV has pledged to have zero net carbon emissions by 2030. It's doing this across four main areas: renewable energy and off-setting; reducing waste; responsible sourcing; and training and culture measures.

From reducing the footprint of outside broadcasts to using the latest technology for cloud-editing, there is a lot of potential for technology and technology teams to have a positive impact. We've talked about it for many years, but the pandemic pushed us to accelerate the changes. There's also greater awareness and sustainability is starting to influence decisions from the outset. The best scenario is when you can improve efficiency and save money at the same time as becoming more environmentally sustainable.

## Sustainability and remote production

Cédric Lejeune (Workflowers)

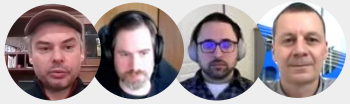
They examined the impact for an animation studio of moving to remote work. The greenhouse-gas footprint increased by about 30% because of the additional machines running (at home and on prem). Calculating the impact of having no commuting depends on the distance and mode of travel. Opportunities to improve might come from thin clients, better data centre power use and virtualization.

The cloud can be great for flexibility but the true environmental cost isn't yet known. There is a tendency to create an acceleration for infrastructure growth and waste. It's worth asking cloud providers for a *full* assessment of their carbon emissions (with a global scope, e.g. about equipment replacement, etc.). You need to be able to compare between traditional and cloudified infrastructure.

Find more information in the Ecoprod study (English version).

# 7: AI FOR PRODUCTION (I)





## MCMA – building complex workflows to transform your media

Loic Barbou (Bloomberg); Joost Rovers (Rovers); Evan Verney-Fink (Triskel); Alexandre Rouxel (EBU)

MCMA is an EBU-developed cloud-agnostic framework to develop media applications. It's about making it easier for media organizations to leverage the benefits of serverless infrastructure (primarily driven by the pay-as-you-go principle), while reducing the risk of vendor lock-in.

It can enable the use of different services from different cloud providers. Workflow orchestrators can help but can lead to vendor lock-in, so the MCMA team is working on the use of Node-RED to provide an open source cloud-agnostic solution.

The mcma.io site provides guidance for writing MCMA projects. There's a walk-through for building a sample service, the creation of an FFmpeg transcode service on AWS. A lightweight path to SMPTE standardization is under way with the Open Services Alliance.

## MeMAD project

Dieter van Rijsselbergen (Limecraft)

MeMAD is an EC-funded project looking at the use of AI and machine learning tools for content metadata. The aim is to help make informed decisions on these technologies and which ones have potential.

Some of the tools are at the stage where productivity can already be measured. In subtitling, for example, while time is saved, there is a need to improve the quality to help with consumer acceptance of the subtitles.

Looking more at the exploration stage tools, automatically-generated metadata *can* start replacing some human descriptions, but the multi-modality (or layering) of the metadata needs to help fill the gaps.

There's a danger with having too much metadata where it would be better to have less, but more accurate metadata. There are challenges in integrating large volumes of rich metadata with the editing tools.

## Future of AI in live streaming

Mark Andrews & Michel Bais (Mobile View Point)

They offer an AI-driven solution for covering live sports. A panoramic camera developed in-house uses multiple 4K cameras that are stitched together. AI extracts the relevant shot, where the action is taking place, from the panorama. Sport-specific rules can be set, e.g. pulling back to a wide shot covering the whole area when there is a free kick. Highlights can be automatically picked out, sometimes using OCR to recognize score changes.

The main use case currently is to extend coverage to events that would not previously have been covered for cost reasons. The solution is sometimes coupled with real camera operators who take care of close-up shots. Typically used for ball sports and ice hockey, it's now extending to motorsports, cycling and equestrian.

# 7: AI FOR PRODUCTION (II)



## BBC R&D work on how AI will shape production

Stephen Jolly (BBC)

Building on its previous work with Primer, a remotely operated unmanned event setup, BBC is experimenting with Ed, where the remote operator is replaced with AI. It starts with face detection and landmarking processes and generates candidate shot framings. Archive content has been analysed to create guidance on which shot transitions to choose and the cadence of changes.

The shot framing and vision mixing still has some issues – many shots have part of another person in them, owing to the focus on faces. Experiments with DeepPose may address this problem.

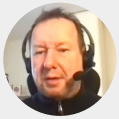
While AI-automated coverage is now practical if one is happy to accept the compromises, there are concerns that its use may lead to harmful biases. The public models and datasets used are probably biased in some way, having usually been trained either by university students or Amazon's Mechanical Turk.

## AI-driven live feed re-composition from TV 16:9 to Mobile 9:16

Thomas Menguy (Wildmoka)

Their solution targets producing mobile-first vertical video from high quality TV content, without disrupting existing workflows or adding a new editorial team. It moves on from existing solutions that that use dynamic detection of the best vertical framing to an approach that defines multiple zones combined into a vertical layout. The news channel BFMTV offers the solution in their mobile app, while Free offers French football highlights in their app.

The tool is cloud-based, taking the on-air stream from the content provider – but it helps to also have the clean feed without graphics. The machine is taught to detect the different types of screen layout and the possible vertical layouts are defined and validated. Then the tool takes over, analysing the stream and applying the appropriate layouts.



## Experimenting with synthetic media

Jouni Frilander (Yle)

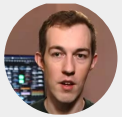
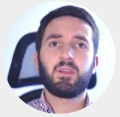
Synthetic media is accelerating creativity and enabling new tools for storytelling. The technology is developing quickly – already a news provider in China uses synthetic newscasters.

Yle has experimented by using the Synthesia platform, creating a digital copy of their own head of innovation to deliver a virtual conference speech. The whole project, which would not have been possible even 2-3 years ago, took less than two weeks. One tip is to use a teleprompter when shooting the sample videos – they did not and the model was thus looking slightly off camera.

Synthetic media will democratize content production and disrupt the media landscape. In addition to obvious concerns around ethics (e.g. with deepfakes), there will also be impacts on how actors are used and remunerated.

# 8: RADIO PRODUCTION



## Radio: merging real-time metadata with personalized cloud streams

Daniel Freytag (SWR); Christian Hufnagel (SWR)

For SWR, the future of radio lies in combining media trends and technologies with the demands of users. One-stream-for-all is fine, but you can do much more today. Linear content is not the future. In their radio app they now offer skippable radio, where users can now skip a track and be given up to three alternatives. They can also save favourite tracks to their own personalized section.

All processing happens in the cloud. The skipping function is built on a tool called Ybrid, where as soon as a user interacts with the stream in some way they are then served their own dedicated stream, with its own session ID. The alternative track recommendations are generated with AI-based music analysis from Cyanite. While the recommendations are genre-based for now, in future they could be based on mood or even a user's own individual behaviour and preferences.

## LIVA & Touchdesigner for radio production

Floris Daelemans (VRT)

The LIVA project aimed to build an open framework of Touchdesigner tools for broadcast. Touchdesigner is a proprietary tool from the company Derivative. The components developed by LIVA are fully open source.

Touchdesigner is a very flexible platform that can read data from anywhere and has lots of input/output capabilities and protocols. For broadcast it can be used to do dynamic graphics based on live data (e.g. GPS, heart-rates), custom UIs, shifting, blending, colour correction, etc… It can also handle audio.

Examples of components created by LIVA include an audio meter and a video switcher. They're all available and documented in the GitHub repo.

## Yellow vest protests in object-based audio

Hervé Dejardin (Radio France)

Radio France used the yellow vest protests as an opportunity to experiment with the potential of MPEG-H object-based audio. The idea was to allow listeners to explore the topic from different points of view. They could both interact with and optimize the audio, for example choosing between different listening modes, from mono smart speakers to stereo or binaural headphones or 5.1 speakers.

The de-rushing stage was the most time-consuming, with such a large quantity of interviews. Different interviewees were matched with different atmospheres. A main narrative for passive listeners was also defined – this was an interesting challenge and is a stage that will require further experience.

The management of Radio France were impressed with the outcome, seeing great possibilities in the future use of interactivity.

## Cloud-based radio production, contributing and delivering

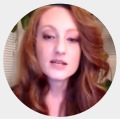
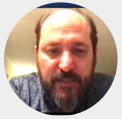
Mikko Nevalainen (YLE)

Yle has developed a radio studio that uses an entirely cloud-based software-as-a-service approach. Once everything has been configured in the backend, the software takes care of connectivity, contribution and delivery. The user just needs a good microphone and can then browse through music libraries and jingles, and connect to pre-configured remote sources.

The solution offers an easy way to replace a studio environment remotely. It can also serve as a lightweight solution when you don't have studio space available.

They are exploring how to deploy the setup as easily as possible, for example using cloud-based distribution with a repository where you can set up docker images to spin up the machine and run the studio environment.

# 9: KEYNOTE

## Virtual production workflows – the "Ripple Effect" film

Kathryn Brillhart & Erik Weaver (ETC)

The Ripple Effect is a short film pushing the limits of virtual production, technology and COVID safety. It reflects a fundamental paradigm shift that's underway, driven by three things: vast improvements in GPU processing, the arrival of tools like game engines and volumetric capture; and COVID-19.

The project was about designing and executing in-camera VFX for smart stage LED walls. It demonstrated that virtual production techniques can be accessible and affordable – there's a requirement to shift VFX resources from post-production to the pre-production stage, so that you walk away from the shoot with final shots and no requirement for post-FX.

The content doesn't need to be photo-real to the eye, only to the camera lens. Loading content onto the LED walls takes time, as does QC. Extra time is needed on set.

# 10: CONVERGING WORLDS

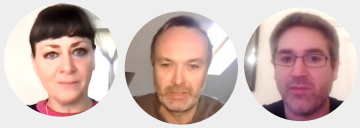
## Broadcast – turning your gaming area into a home studio

Rick Champagne (Nvidia)

A new and fast growing generation of content creators are setting up studios in their homes, built on consumer technology. The Nvidia Broadcast application offers a powerful set of AI-driven tools to handle noise reduction, background blur/removal and virtual environments. For content creation they offer Omniverse, an open cloud-native multi-GPU platform using Pixar's USD scene description format.

The tools have had heavy community involvement: the performance of the RTX Voice noise removal tool was improved greatly when the neural networks were retrained based on real-world recordings submitted.

Enterprise class tools are also available for the needs of professional broadcast centres.

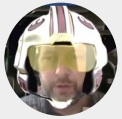


## CG animation, virtual production and real-time creative workflows

Muki Kulhan (IBC); Marc Goodchild (Warner Media); Matthew McCartney (Sky)

This IBC Accelerator project explored the use of VR and real-time workflows to create CG animation. The proof-of-concept aimed to rethink the current 2D-focused approach to animation production pipelines and instead do the animation in a 3D environment. Notably, both Unreal and Unity were involved in the project.

The hypothesis was that making use of VR tools to feed games engines should speed up the creation process and allow for faster iteration. With traditional animation you create your content and then think about the ancillary things to go with it – AR, comic books, etc. This project examined whether the workflow can generate master assets that can be re-used. You begin to create multiple outputs from the same sources. Creating 3D assets in VR is more artist-friendly and opens up multi-format storytelling.



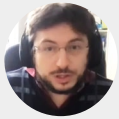
## Game engines in broadcasting

Gregg Young (VRT)

A game engine – like Unreal or Unity – is a powerful 3D engine where you can create any environment you like. You can import 3D assets from connected asset stores, apply physics to the world, make objects interactive, and put cameras inside the world.

Next generation studios will use game engines alongside customized software, cloud services, etc. To integrate all of this it's important to know what's happening under the hood, which is why VRT has been experimenting with game engines. Projects have included VR and AR experiences for their children's channel.

New skillsets are needed, including the node-based approach typical of game engines.



## Using broadcaster archives in games

Marco Mazzaglia (Synesthesia)

Broadcaster archives could offer a new opportunity for integrating content into games. The use of video clips must have a specific meaning within the game – they must be embedded within the game and be influential in some way.

A good example of the potential is the game Attentat 1942, which alternates between cartoons and game sequences, with videos of WWII survivor testimonies. The player can perceive the time of WWII in a different way, keeping it in first person.

Game mechanics are evolving all the time, opening up new possibilities. Think, for example, about an alternate reality game that uses a TV archive as one of the destinations to explore and find clues.

# 11: WHAT'S HOT IN R&D?

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## BBC R&D

If BBC can deliver on the potential of user data, user experiences and the tools themselves, they can utterly transform the organization. A new renewed public service may be "*hardwired onto the internet*".

When it comes to creating new forms of value, the Machine Learning Engineering Principles will in time become as important as the Producer Guidelines are today. Personal data stores are a key focus, and seeing whether BBC can contribute to an internet that enables public service outcomes.

Humans dream, machines don't. So it remains essential to recruit smart people and it's going to be hard to attract and retain them. And on sustainability, "if we don't treat it seriously we don't deserve public funding."

## RAI CRITS

The overall aims are to facilitate innovation, to save operating costs, to facilitate the creative talent, and to provide the public with new experiences. Key focuses are AI, immersive media and 5G.

AI research includes computer vision for classification of pictures and video, assisted creation of data sets from the archives, and data journalism based on Natural Language Processing. They're also testing automated subtitling on regional news.

An ambitious 5G production pilot involves musicians moving around the street playing with (and eventually joining) an ensemble in a room, leveraging low latency and high capacity. And end goal is to enable end-to-end IP remote production.

## NHK STRL

Universal service is one key focus, with the development of an IoT-based media framework connecting broadcasting output and IoT devices. They are adding touch (through the 'haptic cube') on top of sight and hearing.

They're also exploring more efficient content production using AI technology. Automated transcription during the creation of video footage will help to enable automated production later. Also lots of work on automated summarization, with image analysis to calculate scores for caption size, face size and camera motion and using these scores to automatically generate highlights videos.

Research on immersive media is heavily focused on human perception and cognitive abilities, to enable viewers to enjoy hyper-real content in a variety of styles.

## Fraunhofer IIS

MPEG-H Audio is naturally a big focus, with one strand of work involving the use of deep learning to estimate audio objects. This could enable broadcasters to bring the benefits of dialogue enhancement to archive content.

For immersive audio, work continues on making it easier to bring it into homes through user-friendly consumer devices like sound bars, which feel like a multi-channel system but have a much simpler setup. On mobile devices with headphones, binauralization creates more immersive experiences.

The MPEG-I standard for VR and AR aims to move to '6 degrees of freedom', to be able to move through a concert hall or sports stadium freely. The CfP is underway and the technology should be available on devices in 3-4 years from now.

# 11: WHAT'S HOT IN R&D?

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## Fraunhofer HHI

The newly standardized VVC codec offers a 50% bit rate reduction on HEVC. Software decoding at 60fps is now available. The encoder and decoder implementations are available on GitHub.

HHI's work on 5G focuses on the Open Random Access Network, where the main advantage is support of multi-vendor solutions. Integration is the main challenge as they work on distributed units and remote radio units.

6G is further down the track, where AI use cases enabled by networks will come into play. Use of higher frequencies is another key technology driver for 6G – up to millimetre and terahertz waves.

Volumetric video capture is another key work area with broadcast applications.





## Panel: The future of R&D and innovation

Andy Conroy (BBC), Kohji Mitani (NHK), Gino Alberico (Rai), Harald Fuchs (Fraunhofer IIS), Ralf Schaefer (Fraunhofer HHI)

***AC***: BBC believes that an institution based on **public service media can still play a vital role in the internet age**. We can bring our values to bear on the space.

***KM***: It's indispensable to create new services based on highly advanced ICT, but since it is humans who ultimately receive the content, **research on basic sensory things and cognitive psychology** is essential.

***GA***: The question is always to **make or buy? The hybrid approach is the best**. Being inside the company allows to know the context very well and to think about both the evolutionary path *and* the legacy situation, avoiding vendor lock-in for example.

***RS***: We have to work on topics where they get funding. One problem is that the CE industry is gone from Europe, so it's **hard to get funding for CE or broadcasting topics**.

***HF***: European projects continue to be important and **the EBU has a role to bring together the requirements and views of the broadcasters**. You can't only rely on the big West Coast US players who naturally have to have a global view.

***GA***: Rai is doing similar if not identical activities to many of the presentations seen at PTS 2021, asking the same questions. We are small – **collaboration is essential**!

***RS***: Dependency on certain cloud providers that might be an obstacle for collaboration. **GAIA-X is an opportunity** to work on an open standardized platform that might be an argument for the European Commission to give more money for collaboration.

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