

# NETWORK TECHNOLOGY

## SEMINAR

AN EBU EVENT



# YOUR NETWORKED MEDIA & IT RENDEZVOUS

## EVENT SUMMARY

15–16 June 2021

Presentations and videos:

<https://tech.ebu.ch/events/nts2021>

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. EMBRACING THE CLOUD



## How RTÉ is embracing the cloud

Conrad Gouws (RTÉ)

Faced with having to replace a huge amount of legacy equipment and the impossibility of doing so at the rate required, RTÉ turned to the cloud. Concerned about the OpEx cost model of the public cloud, they adopted a hybrid model: office systems and workflows were moved to the public cloud and they built a private cloud for everything else.

Their cloud providing virtual compute, block storage and network functions is named Nebula. Now, when systems come up for renewal, they get built in Nebula. There are 900 virtual servers running at any given time, covering the majority of regular production systems.

Aurora is their hybrid storage cloud, offering 4.9 PB of scalable object storage for all RTÉ applications. It can seamlessly replicate files into public cloud providers. Nebula uses two on-premise data centres; Aurora also uses an additional offsite one. Future efforts will focus on introducing more automation.



## Moving infrastructure to the cloud? How to measure the impact

Cédric Lejeune (Workflowers), Benjamin Davy (Teads)

Cloud is a great way to add scale and flexibility, but at the end of the day it's just someone else's computer. Many media companies have announced net zero strategies, but without knowing the environmental impact of the cloud. There tends to be a focus on electricity consumption (Scope 2), while ignoring emissions from manufacturing and transport (Scope 3), which are hard to measure.

Focusing only on compute functions in a data centre ignores emissions related to storage and network, as well as the machines that run the facility.

[Cloud Carbon Footprint](#) is a useful open-source tool; the [Boavizta](#) project is also developing a tool. Nevertheless, current efforts are mostly based on reverse engineering and scientific studies – more transparency from providers is needed. When doing an RfP, it's important to ask vendors for verifiable information to evaluate the impact of the project. See also the [EBU Sustainability Group](#).



## Audio in the cloud with AES67

Nicolas Sturmel (Merging Technologies)

With increasing use of the cloud for remote production, there is an interest in using AES67 audio streams in a WAN and in the cloud. The AES67 standard committee has been working on recommendations, which should be released soon.

The main considerations are stream quality and reliability, rather than timing or the protocols to be chosen. While there are latency issues when using a WAN, there are many ways to work around them, such as mix-minus. Virtual machine operation is possible, but it's not yet plug-and-play. While time is very important for audio streaming, it may not be so crucial here since it is transported within the AES67 packets. In all cases, IT best practices are crucial.

Some practical examples were described, including a [December 2020 demo of AES67/RAVENNA over SRT](#) and the use of the Merging Audio Driver in virtualized windows.



## High-quality live production in the cloud, with CDI and JPEG XS

Thomas Edwards (Amazon Web Services)

JPEG XS is a high-quality mezzanine codec with low complexity and low latency (about 1 frame in real-world implementations). It is a great option for moving media onto and off the cloud. A royalty is required for use.

JPEG XS is combined with ST 2110-22 (for constant bitrate RTP payloads) for [AIMS IPMX](#), which is aimed at ProAV use cases but can be used for moving materials into and out of the cloud.

AWS proposes the use of CDI (cloud digital interface) to create reliable data flows for uncompressed video, audio, and metadata inside the cloud. This provides a more reliable performance compared to UDP. It can be used only within an availability zone, with JPEG XS again used for transfers between zones in a redundant setup. A CDI SDK is available for both Windows and Linux and as [an open-source project on GitHub](#).

# KEYNOTE // 2. GOING HYBRID



## Keynote: Adopting cloud-based live production workflows and technologies

Paul Cheesbrough (Fox Corporation)

With the acquisition of Disney in 2019, Fox had a chance to go greenfield in terms of technical facilities, leaving behind an operation built in the late 90s. They built an entirely new facility at the Arizona State University Research Park, with one of the critical factors being availability of talent. Construction was completed in 18 months; the technology team went from 550 (mostly hardware) staff to ~220 (mostly software). Future-proof technologies were chosen, including ST 2110. They are collocated with AWS, with a very close partnership for the project. They leverage JPEG XS on uncompressed video in the cloud, with ultra-low latency.

It's a very modern operation that's both agile and elastic to be able to scale for future needs. Data is used throughout, also allowing them to be more proactive, for example spotting the Fastly CDN outage before it happened. They have reimaged the way teams can work, thinking about video holistically, regardless of the platform it's going out on.



## Video editing in VRT on-prem cloud

Jonas Rymenants & Joris Grauwels (VRT)

During the pandemic, VRT was able to quickly shift to remote editing, having previously experimented with it. Editors were able to take over all 35 physical editing booths remotely, using HP Zcentral Remote Boost. This remains a standard solution today.

As a next step, VRT conducted a POC on cloud-based editing. The reactions from users were negative, with latency problems. Users expect a solution that fully integrates storage, network, media systems and archives. VRT thus set up a new POC to use virtualization of the editing stations. They have succeeded in building a scalable system that deploys virtual desktops automatically. The VMs use Cisco servers in an on-prem data centre, using VMware vSphere with Nvidia RTX 8000. The virtual GPU uses Nvidia Grid.

Feedback from users has been very positive. And the hardware can be used for other functions at night-time, such as AI and encoding.



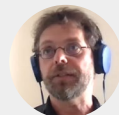
## VRT's approach to going hybrid

Willem Vermost (VRT)

When considering hybrid cloud production, it's a case of whether you handle each of acquisition, processing and control on-site or off-site. Different combinations will apply to different scenarios. VRT uses its IP.Lab as a learning space for the new generation of standards and protocols, with experiments including network stress-testing and PTP performance tests.

Another track for VRT is looking into software-based studios. The Gallery 42 project (based on [RTBF's CR42](#)) splits the controls from the processing power, which means it can be driven by a single user and anywhere. It will be used for covering the Tokyo Olympics. Another project, Gallery E<sup>2</sup>, splits acquisition, processing and control, using microservices, HTML5 interfaces and WebRTC.

VRT has also been working on the creation of compact production kits that use prosumer gear – used on-site or remotely – and using game engines to create and shoot in virtual sets, both for large and small-scale productions.



## RIPE Atlas: probing the state of the internet

Emile Aben (RIPE)

RIPE is one of five regional internet registries, allocating and registering internet resources, such as IP addresses. For over ten years it has been running the [RIPE Atlas](#), a tool to probe the state of the internet. The internet has no guarantees for packet delivery, latency or jitter. To deal with this you need to monitor it and deal with anomalous conditions when they occur.

The Atlas is an internet-wide measurement system for the infrastructure – the IP layer and the things around it, like DNS. It has real-time and historical information, covering 5% of the 72k autonomous systems that make up the internet, with probes in 175 countries. (Use [this link to check individual countries.](#))

It uses a credits-based system for those who want to do measurements that are not provided by default. Most EBU Members should have credits as members of the RIPE NCC.

# 3. DELIVERING ON-PREM



## Introduction and tour

Félix Poulin & Francois Legrand (CBC/Radio-Canada)

Radio-Canada is in the process of migrating into its new HQ, which is fully based on ST 2110 (and AES67 for all audio). A live tour of the facility started in one of four identical fully automated control rooms used to create local and national TV news. A central element of this is the Lawo VSM panel that allows the switcher director subscribe the control room to any studio available throughout the facility with a simple touch of a button. The tour also visited the acquisition room, the radio studios, and the media presentation centre (which brings together all of the different platforms on which Radio-Canada distributes) and the central equipment rooms. See the video for details on the products and tools used in each room.

For production staff, whether in TV or radio, the workflows have generally not changed with the move to IP. The changes are more for the technical team, but they are quickly getting to grips with the IP technology. The [EBU LIST](#) tool helped to diagnose a problem with lip sync.



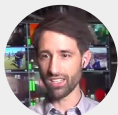
## Networked microphones and IEM

Anthony Kuzub (CBC/Radio-Canada)

CBC in Toronto is a particularly complex place for using wireless production equipment: the studios are directly below a of transmission tower, with radio and TV coming off the tower above.

There is no such thing as zero delay with audio, but the only delay that matters to a performer is the delay of *their own voice in their ear* relative to their mouth. It's therefore necessary to consider the workflows needed to offset the delay introduced in an IP-based production facility.

The feedback to the in-ear monitor has to be generated locally, but the summing system needs to be controlled remotely. There is a need to better understand the network controlled devices. While EBU LIST can help measuring delay in the IP domain, when measuring in-ear monitoring, you have to use old-fashioned methods. The use of wireless production equipment has also been complicated by the reallocation of some parts of the radiofrequency spectrum for 5G mobile telecoms.



## Metecho: one year after 'on-air', what has changed?

Sandro Furter (SRG)

Metecho is the name of the technology installation in the new SRF building in Zurich, which went on-air in June 2020. It is fully based on ST 2110, with 526 native IP end devices. There have been no outages at all in the first year.

Having a well-established and single orchestrator for the whole network was a very good decision. It is a centralized tool that knows everything about the network, which helps with troubleshooting and analytics. There are often questions about redundancy when it comes to IP-based production, but you actually have more redundancy than you had in the SDI environment. Training users took a lot of time – it is not plug and play anymore.

The concept of bouquets was created to simplify the handling of audio streams: there is a series of audio channel configurations that are allowed within the network. Bouquets are virtual groups of streams, with automated stream mapping.

Next steps include exploring hybrid cloud production, which the network supports.

# KEYNOTE // 4. LOOKING INTO THE FUTURE



## Keynote: The race to re-tool the media factory

Mark Harrison (DPP)

The arrival, around 2007, of public cloud (from Amazon), streaming video (from Netflix), and the app-driven smartphone (from Apple) completely changed the media landscape. Consumer electronic goods, which are focused on audiovisual content, now represent more than 80% of the global consumer tech market.

The means of production is now becoming a key differentiator. Making good content isn't enough anymore – it has to come with agility, speed, scale and a great QoE. This is only possible with industrialization. Media is now a retail industry.

Supply chain principles are now key to modern media. Sky, Fox, Disney, etc have all deliberately disrupted their own businesses in order to compete, using this kind of industrial thinking. “You must need to be prepared for the unknown.”



## Virtual production – the new picture

Ed Plowman & Raed Al Tikriti (disguise)

The use of AR (augmented reality) and MR (mixed reality) offers several possibilities for media production, including set extension (blending the virtual and physical world), overlay of AR graphics that presenters can walk around, and “teleportation” of remote contributors into the studio. [Katy Perry's American Idol performance](#) in 2020 was a watershed moment.

Working practices are still being formed in this area – disguise has improved its knowledge through producing 280+ shows. Tracking is probably the biggest challenge – aligning the physical and vertical worlds – as most solutions were built for continuity purposes and don't offer the accuracy and precision required.

Technical progress is focused on geometric and temporal calibration, automating it as much as possible; on colour, moving towards being able to calibrate colour spaces in real-time; and on scalability, with regard to rendering resources.

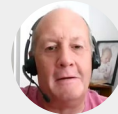


## Synthetic reality: VR/AR meets broadcasting

Michael Nunan (Bell Media)

Bell took the opportunity of having to move its annual “network leadership conference” online to test the possibilities of running the event in a VR environment. In order to convince senior management, they settled on a Mixed Reality approach, where real presenters would be keyed into the virtual environment. Every attendee can have a different, but shared, experience. The first version was run in April, with an improved version planned for autumn.

One of the challenges was that there isn't a single composite “product” that can be QCed before being distributed – the parts are being reassembled in the user device. Managing the timing was another challenge, since commands (like “turn on the lights”) can be sent instantly to the headsets, but the media flows take time. The Unity game engine was used to generate the environment. VR sessions were limited to a maximum of an hour, and a 2D mix was produced as an alternative.



## Quantum Technologies and their applications for telecommunications

Andrew Lord (BT)

Quantum technology is essentially about harnessing the properties and behaviour of very small things, like atoms and photons – and abilities have improved vastly in recent years. Commercial applications are starting already. Quantum computing takes advantage of “entanglement” (where two or more particles behave as if they are one and retain this link even when moved apart from each other). A quantum computer could break current day cryptography by finding the private key through the public key within minutes or hours (rather than billions of years with standard computers). This is likely to happen within the coming years.

Quantum communications offers a new approach to cryptography. With QKD (quantum key distribution), instead of a public-private key combo, we send a single private key, refreshed thousands of times a second. It is unhackable, since even observing a key changes it. BT and partners have commercial QKD products ready to roll out. While [global distribution via satellite is already possible](#), QKD over networks remains a challenge.

# 5. TECHNOLOGY BRIEFINGS



## Understanding how clouds are built

Thomas Kernen & Richard Hastie (NVIDIA)

The three main cloud providers all essentially do the same things, applying their own brands to the different services and functionalities. Avoiding vendor lock-in is crucial so that you can benefit from a multi-cloud approach, where the key to success is the cloud management layer that makes it possible to address all the cloud providers in the same way. There are several cloud management platforms available, as well as open-source solutions.

The talk goes into detail on how the elements of the virtual machine relate to the elements of the physical machine on which it runs. It explains how the CPU, GPU and NIC functions are virtualized, how ports are shared via VLAN or VXLAN and how memory can be allocated. It is important to understand these concepts as they are the virtualized building blocks of the cloud-based system you are designing. For example, keeping resources connected to the same PCIe NUMA is the key to low latency in the cloud.



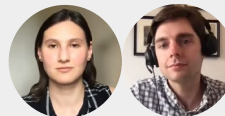
## Perfecting ST 2110 with testing capabilities

Willem Vermost (VRT), Pavlo Kondratenko (EBU)

The experience gained through the [JT-NM Tested programme](#) has shown there is often confusion around the terminology used. ST 2110-25 is forthcoming and will aim to provide clarity on the terminology and methodology used for measurement of things like latency, timing, margin and RTP offset.

SMPTE is also working on a Protocol Implementation Conformance Statement (PICS) for ST 2110 that should help lead to better implementations. It's a structured document that provides a checklist of requirements, translating shall, should and may statements from the standard. Self-testing in JT-NM Tested will consist of filling in the PICS. The next test event is planned for spring 2022.

EBU LIST 2.0.0 will be launched in the coming days at [tech.ebu.ch/list](http://tech.ebu.ch/list). It is cloud-based and introduces a new interface and new measurement options, including a stream comparison tool. The roadmap includes RIST, SRT, and ST 2110 PICS.



## Getting started with cloud deployment for media applications

Georgina Shippey & Sam Mesterton-Gibbons (BBC)

Provided an introduction to common cloud deployment and configuration management tools with a focus on open source. The example shown went through the deployment of an NMOS registry and node along with an authoritative DNS server for the NMOS node to use for service discovery. The demo ran on an on-prem [OpenStack](#) cloud.

Demonstrated the deployment of two virtual machines along with the required security and networking elements. Several tools were shown: Docker to create containers in which to run the applications; images from Docker Hub to set up the containers for the [NMOS registry](#) and the [DNS server](#); Terraform to simplify the cloud infrastructure deployment; Cloud-init for initial configuration of the VM; and Ansible, an automation tool aimed towards configuration.

BBC R&D's [Cloudfit](#) team is experimenting with media production built around microservices, using Docker and Terraform, with deployment via Jenkins.



## One more thing... Keep safe!

Gerben Dierick (VRT)

Security was not explicitly on the NTS programme this year, but it remains a critical concern. The usual advice applies: keep systems patched, don't reuse passwords, limit access and keep systems isolated from the whole internet. Avoid [bike shedding](#) and [yak shaving](#)!

Whether considering security for cloud or on-prem or hybrid, you must ask the right questions. You need to explicitly ask and answer two questions: What are you protecting? And what are the threats? For example, with remote editing of a news report the main concern might be availability, whereas for a Hollywood movie (or unblurred footage of a news source) the main concern might be confidentiality. For on-prem delivery, isolation of systems is the most obvious security control.

The next [EBU Media Cybersecurity Seminar](#) will take place in October.

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# SEE YOU IN 2022!

(Check out the [next EBU Live IP Production Masterclass!](#))

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