

# HVORDAN KAN 5G REVOLUTIONERE MEDIEINDUSTRIEN?

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# **HVORDAN 5G VIL REVOLUTIONERE MEDIEINDUSTRIEN!**

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# HVOR RAMMER 5G TV 2?



Enduser

smartphone  
FWA - 5G som fiber  
Nye tjenester



Broadcast  
distribution

TV  
Radio



Content Production

live  
Production services

# **HVOR FOREGÅR 5G DISKUSSIONEN?**

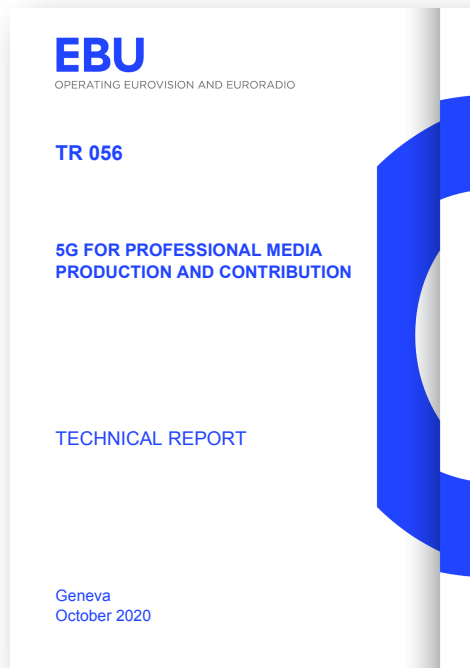
- **EBU – arbejdsgrupper**
- **Nordic 5G Consortium**
- **5G RECORDS**
- **5G MAG – Media Action Group**
- **IBC Accelerator 5G**



# INTERNATIONALT 5G SAMARBEJDE OG PROJEKTER

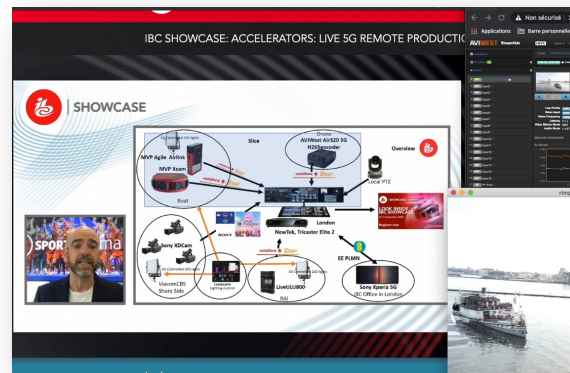
Efterår 2020

## EBU Techhical report



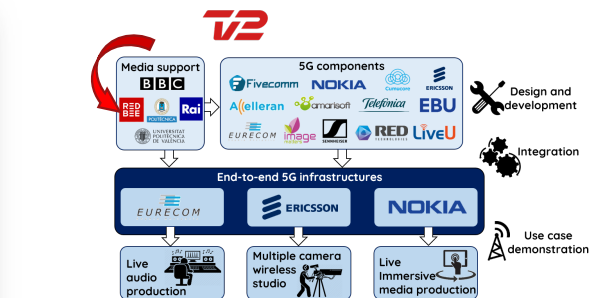
/ **Content production og 5G**

## IBC accelerator live demo 5G remote production

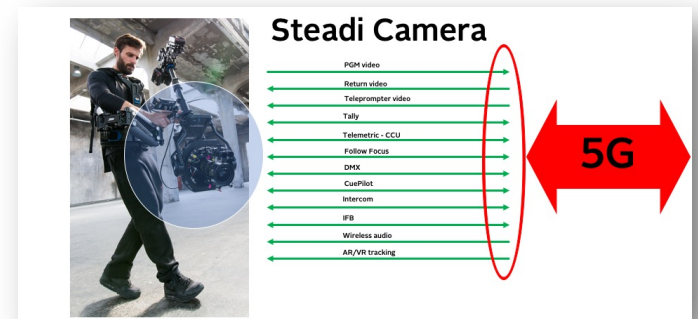


- / **AI driven multicamera production**
- / **Slicing and QoS**
- / **5G remote production**

## 5G-RECORDS 5G Multicamera production



- / **A joint EU 5G PPP Horizon2020 project**
- / **BBC, RAI, EBU, TV 2**



# 5G REMOTE PRODUCTION

## Challenge:

To research, design, evaluate and test 5G Remote Production use cases.

IBC cancellation presented an opportunity to put concepts into creative action.

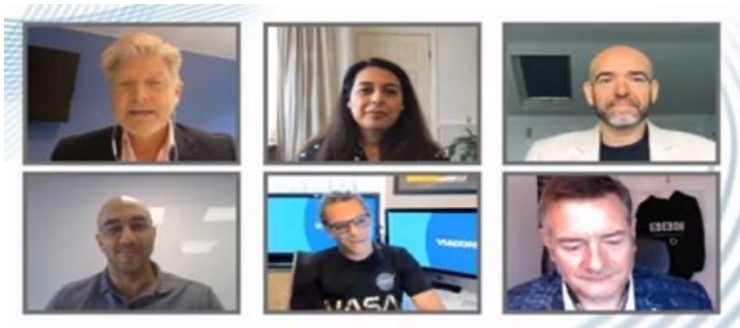
Bringing Amsterdam to IBC Showcase, *live* across 4 locations, including the RAI, London and a performance from a rising MTV star from a boat, using AI enabled cameras over 5G.



#IBCaccelerators



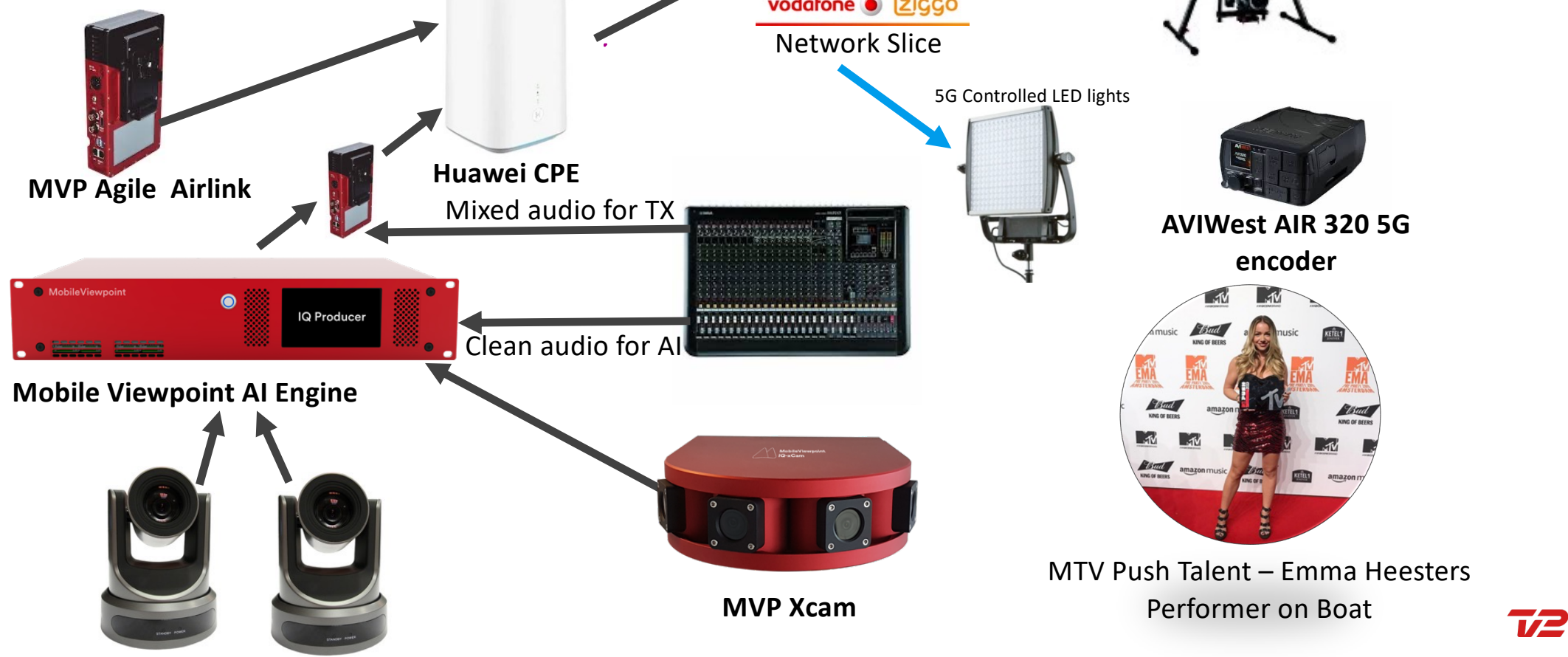








Kapitein Anna



MVP Agile Airlink

Huawei CPE  
Mixed audio for TX

vodafone Zigo  
Network Slice

5G Controlled LED lights

AVIWest AIR 320 5G  
encoder

Clean audio for AI








Mobile Viewpoint AI Engine

MVP Xcam

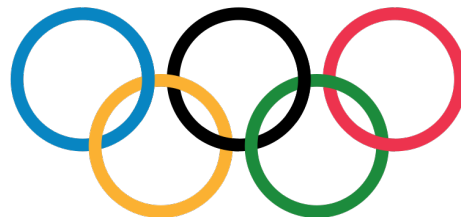
MTV Push Talent – Emma Heesters  
Performer on Boat



# OLYMPIC BROADCAST SERVICE – 5G CASES

<p><b>#1 FWA</b></p> <p><i>Beauty Camera</i></p> <p>IBC No Mobility UL Throughput Public Areas/City</p>		<p><b>#3 Outdoor</b></p> <p><i>Cross-country</i></p> <p>Mobility Outdoor Field of Play Coverage Compound</p>		<p><b>#5 VR</b></p> <p><i>VR CAMERA</i></p> <p>IBC Limited Mobility UL Throughput Field of Play coverage IBC/Compound</p>		<p><b>#7 ENG</b></p> <p><i>Near Live ENG</i></p> <p>Venues Mobility UL Throughput Back of House coverage 5G Consumer-type SLA</p>	<p><i>Other Use Cases</i></p>
	<p><b>#2 Outdoor</b></p> <p><i>Alpine</i></p> <p>Limited Mobility Outdoor Field of Play Coverage Compound</p>		<p><b>#4 Indoor</b></p> <p><i>Curling</i></p> <p>Mobility Indoor Congested environment Field of Play Coverage Compound</p>		<p><b>#6 Drones</b></p> <p>Mobility Latency UL Throughput Field of Play Coverage</p>		

## BEIJING 2022



# 5G SA NPN LAB TEST NOKIA-BELL LAB/ AAU

To investigate the possibilities of using 5G Standalone NonPublicNetwork for TV production, a test was set up in collaboration with AAU / Nokia-Bell lab.

The goal was to test how a TV production camera can work in a 5G network, including remote control of the camera's aperture, filter and focus, just as if the camera were wired.

H.265 video encoding was used, with a total relatively long delay (+ 500ms) as a result, from camera to media gateway. HD video was tested at 10 and 20Mbps.

Test setup was placed on an industrial robot, whereby it was possible to test how mobility affects performance and stability.

The result of the test was a stable video signal and full wireless control of the camera. It shows a clear potential for using 5G SA NPN for content production.



**AALBORG  
UNIVERSITY**



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# TEST SETUP

## Camera specifications and settings:

Camera: Sony HDC p1

Video Encoder: Awivest air320-5G 5G modem: Sierra Wireless EM9190

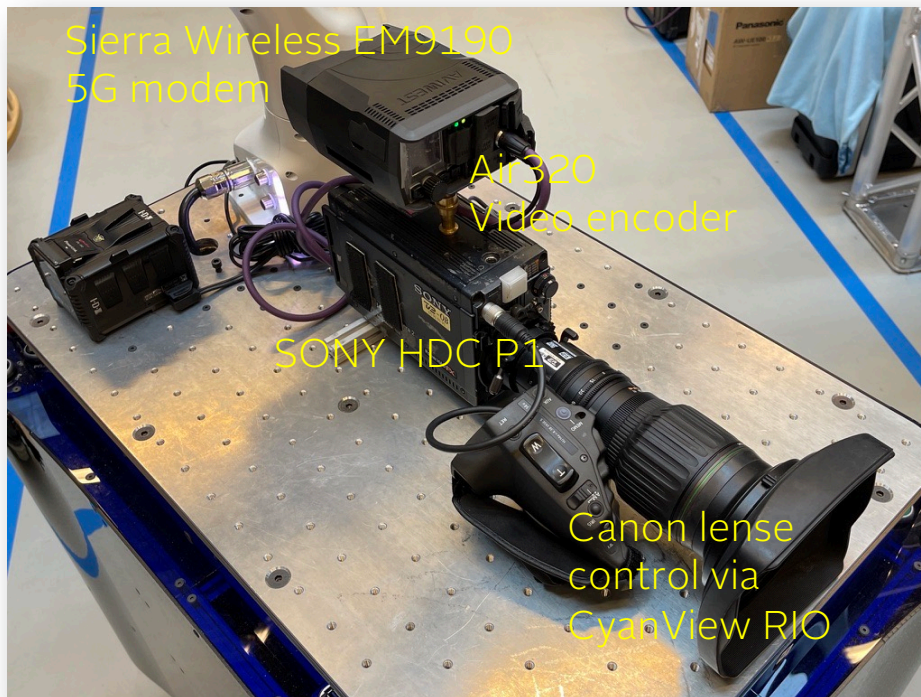
1080i - 50 fps - bitrate: 10mbit/s

1080i - 50 fps - bitrate: 20mbit/s

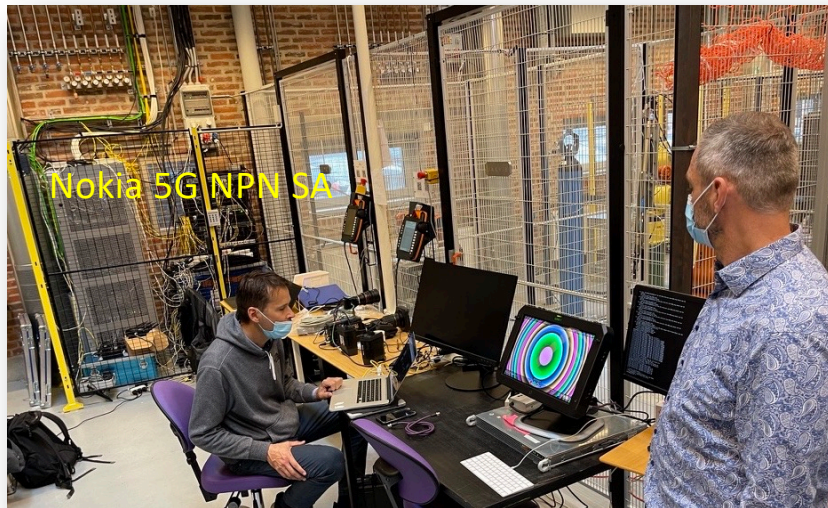
## Camera traffic:

10 Mbit/s bitrate: 1100 Packet/s - 1400B packets - 12,3 Mbit/s

20 Mbit/s bitrate: 2300 Packet/s - 1400B packets - 23 Mbit/s



# AAU/ NOKIA-BELL LAB PRIVATE STAND ALONE (SA) 5G NETWORK



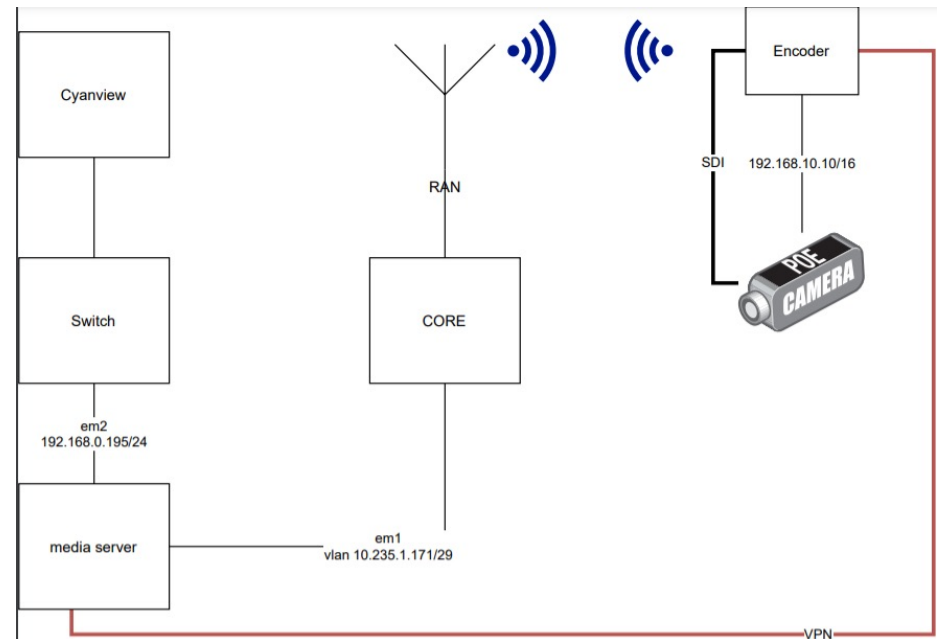
3.7GHz with 100MHz bandwidth and 30 KHz subcarrier spacing.

Modulation: QUAM

*Maximum Throughput:*

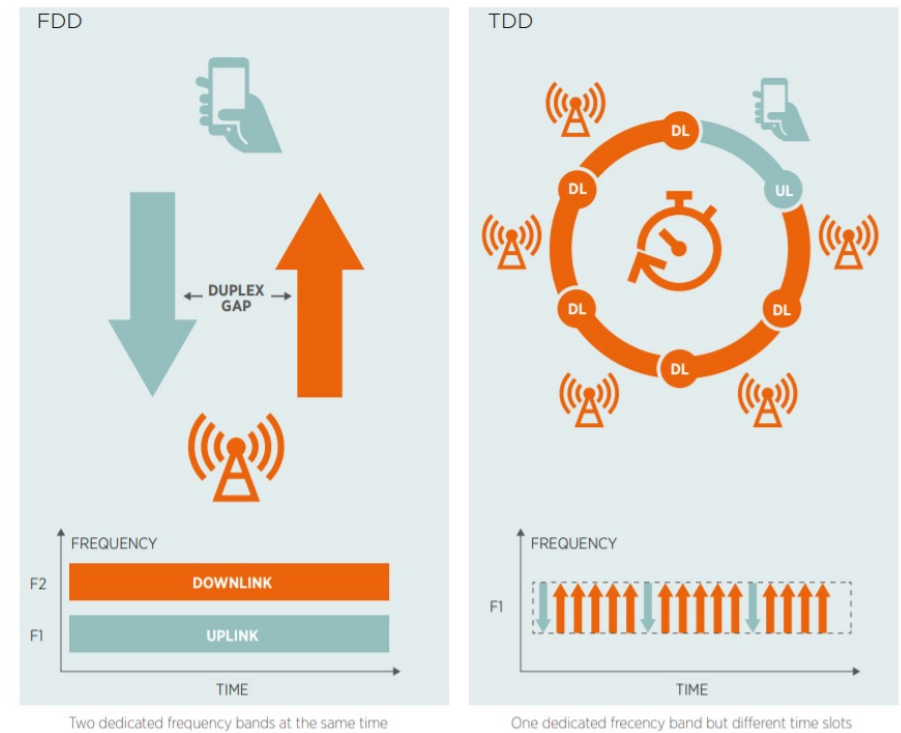
- 1/4 TDD frame = 30 Mbit/s uplink & 1 Gbit/s downlink.
- 3/7 TDD frame = 70 Mbit/s uplink & 600 Mbit/s downlink.

*Average end-to-end RTT: 10,5 ms*





# TDD - FDD



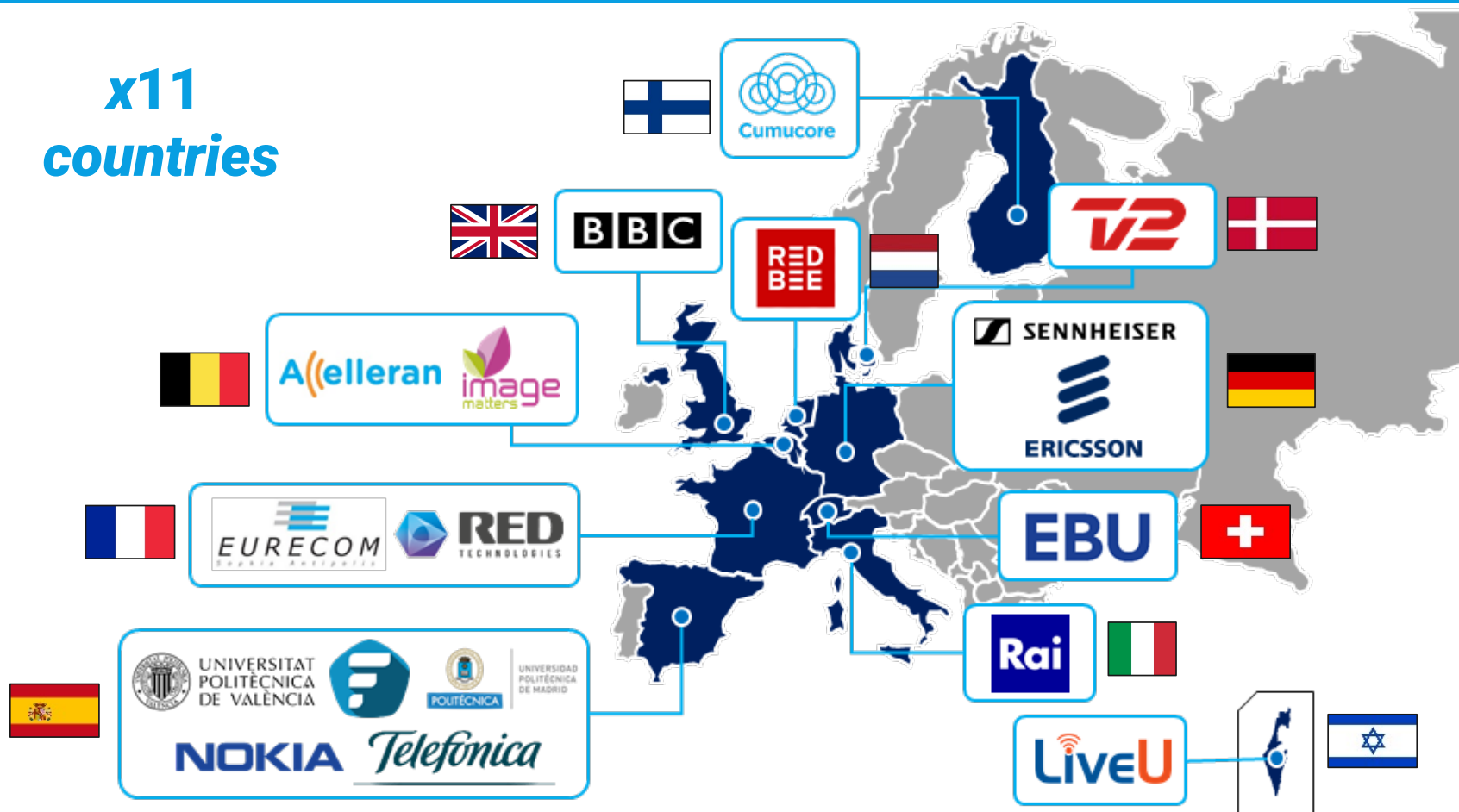
To utilize the spectrum most efficiently, all TDD networks, either LTE or 5G, operating in the same frequency range and within the same area have to be synchronised. Base stations need to transmit at the same fixed time periods and all devices should only transmit in dedicated time periods.

# 5G-RECORDS

5G key technology enable**R**s for **E**merging media **C**ontent p**R**o**D**uction **S**ervices

# CONSORTIUM

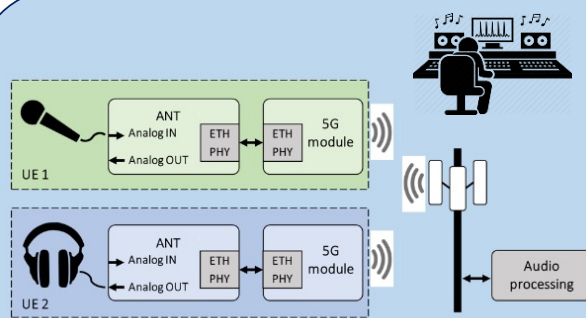
x11  
countries



x18  
partners

## Live Audio Production

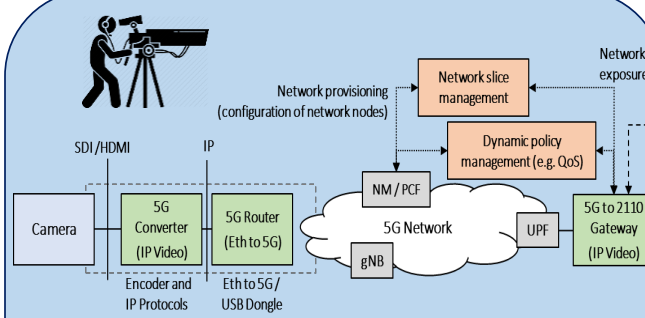
5G RECORDS



- Open and Virtualised RAN
- NR-RedCap & URLLC
- Software Defined Radio
- Dynamic Spectrum Access

## Multiple Camera Wireless Studio

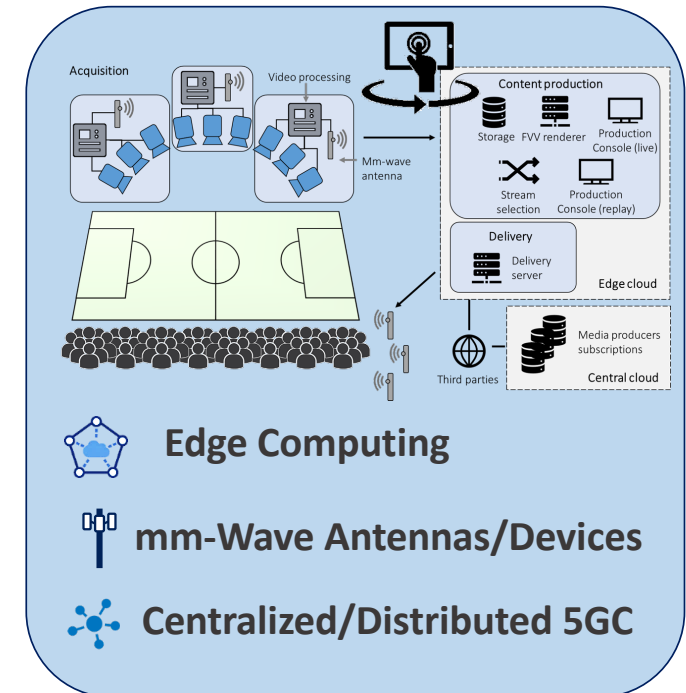
5G RECORDS



- Non-Public Networks
- Timing and Synchronization
- Network Slicing
- Media Orchestration

## Live Immersive Media Production

5G RECORDS



- Edge Computing
- mm-Wave Antennas/Devices
- Centralized/Distributed 5GC



### Design

of 5G components for professional content production



### Development

of state-of-the-art 5G prototypes



### Integration

into end-to-end 5G infrastructures



### Validation

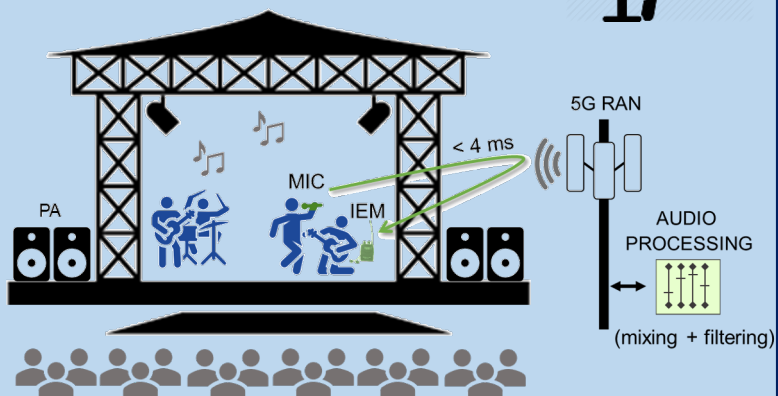
in the context of real production use cases



### Demonstration

of the potential value for the sector

## Live audio production



Open and virtualised RAN



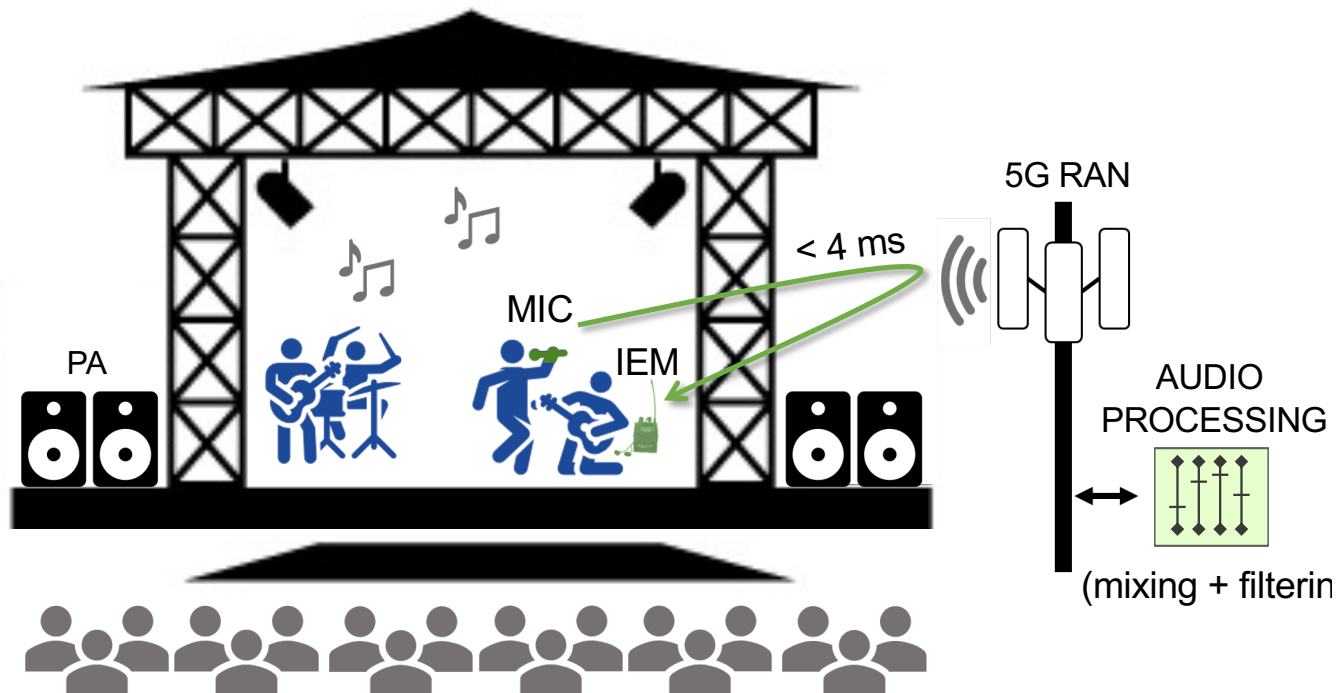
NR-RedCap & URLLC air interface



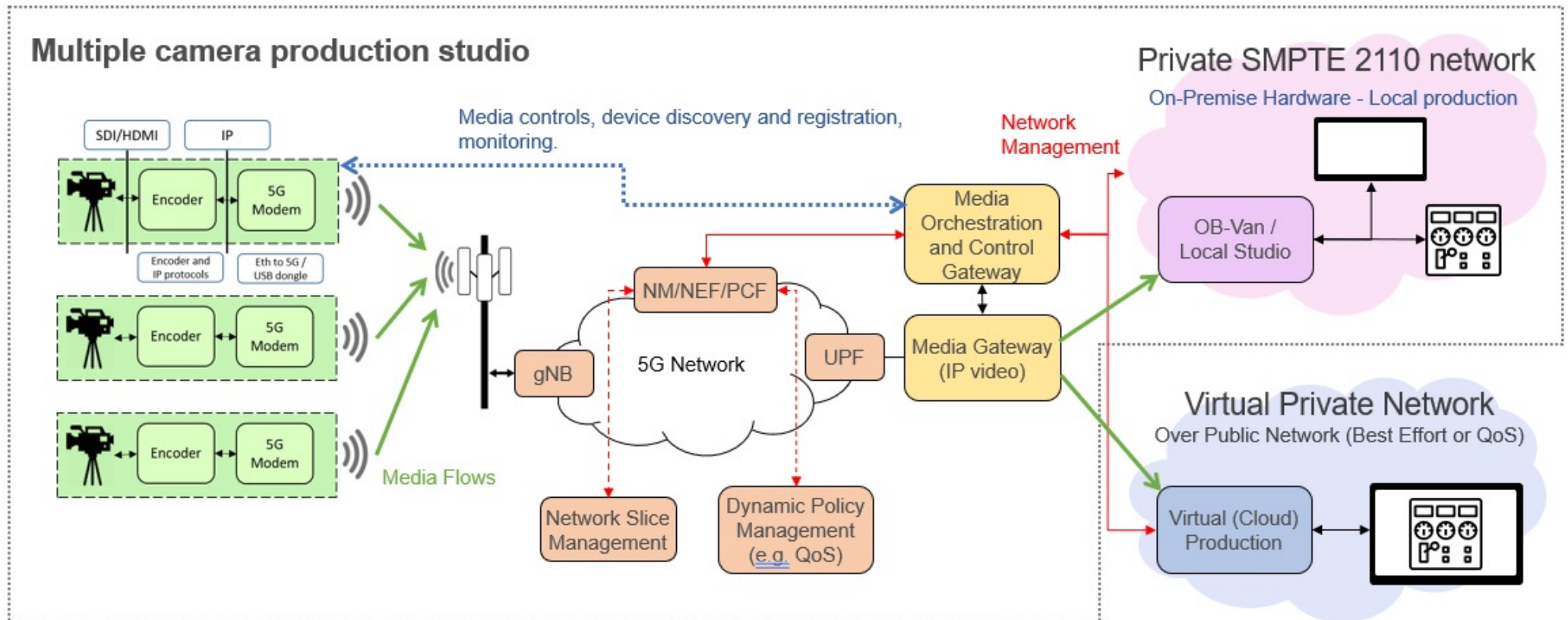
Software Defined Radio



Dynamic Spectrum Access



# UC2 block diagram







# ERICSSON 5G LAB – AACHEN

*MAY 2021*

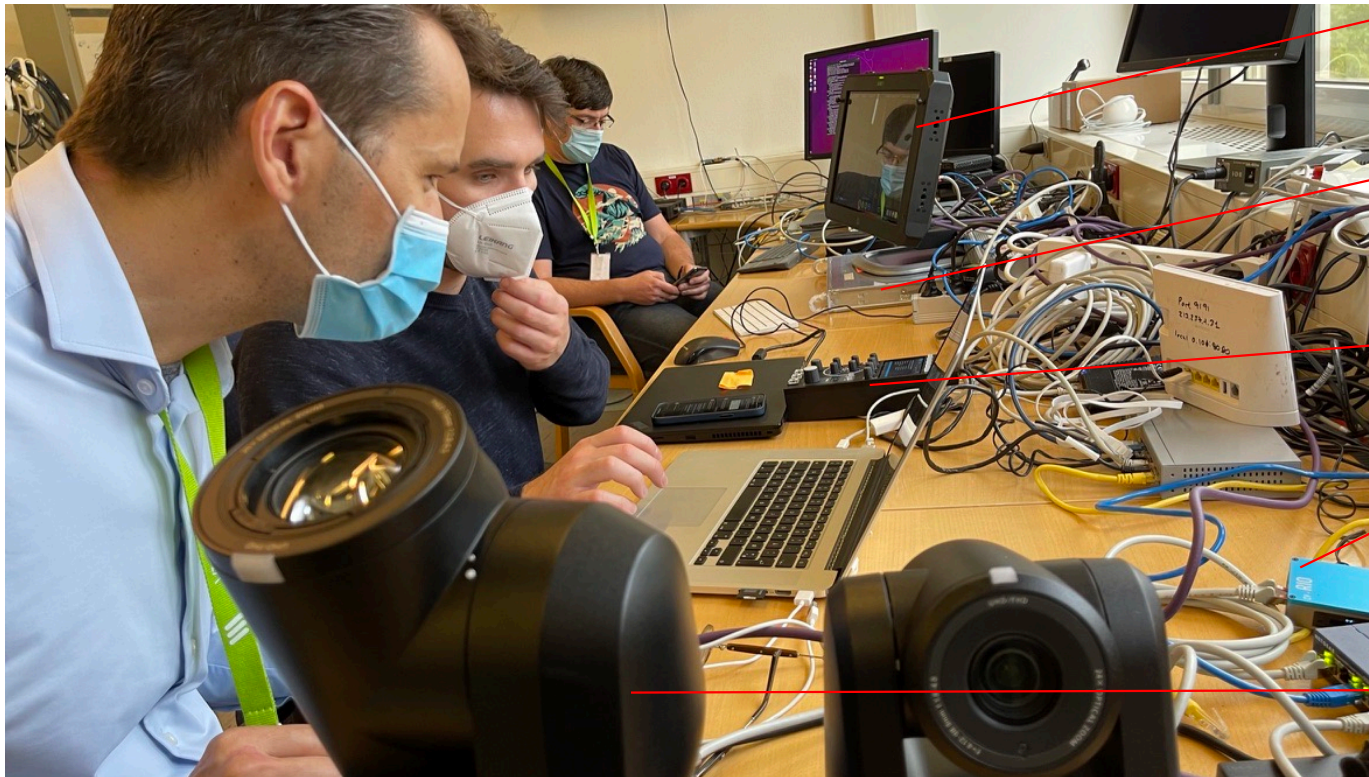




# PTP TIME/SYNC



# CAMERA + REMOTE RCP



ATMOS Sumo monitor /  
recorder

Mediagateway  
*AVIWEST streamhub*

CyanView RCP

CyanView RIO

Panasonic AW-UE150



**5G REMOTE CONTROL**





Studio or OB live production are a mix of camera:

- cable
- wireless (handheld, Steadi, robots)

**5G  
RECORDS**

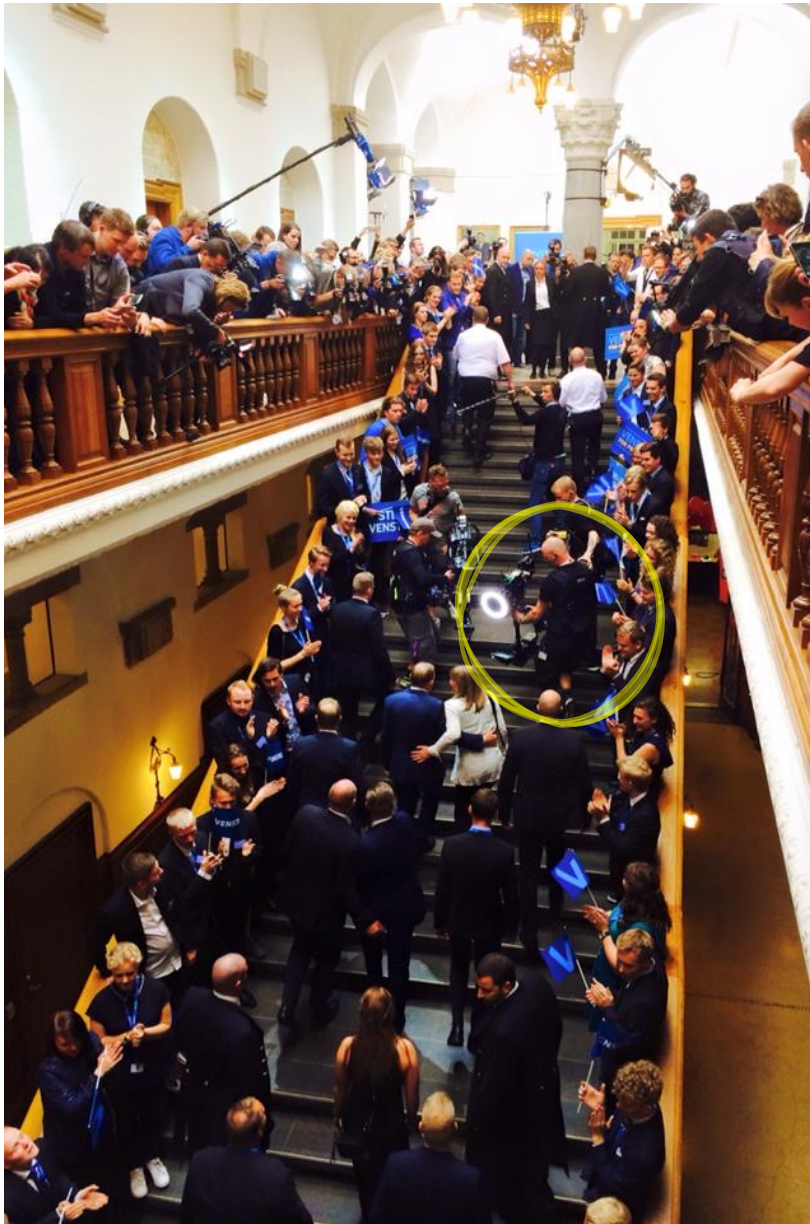


# TIER #1 SYSTEM CAMERA – OB AND STUDIO

5G  
RECORDS





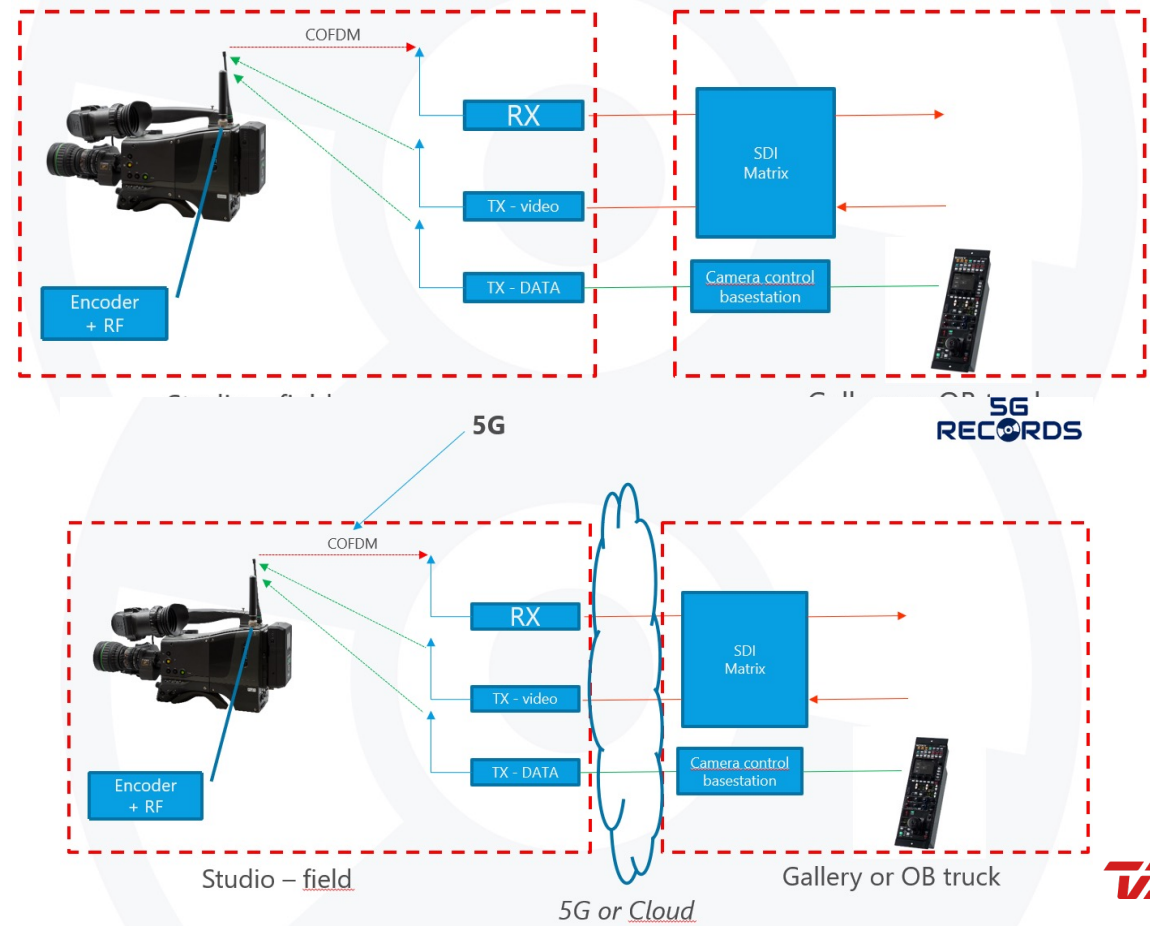
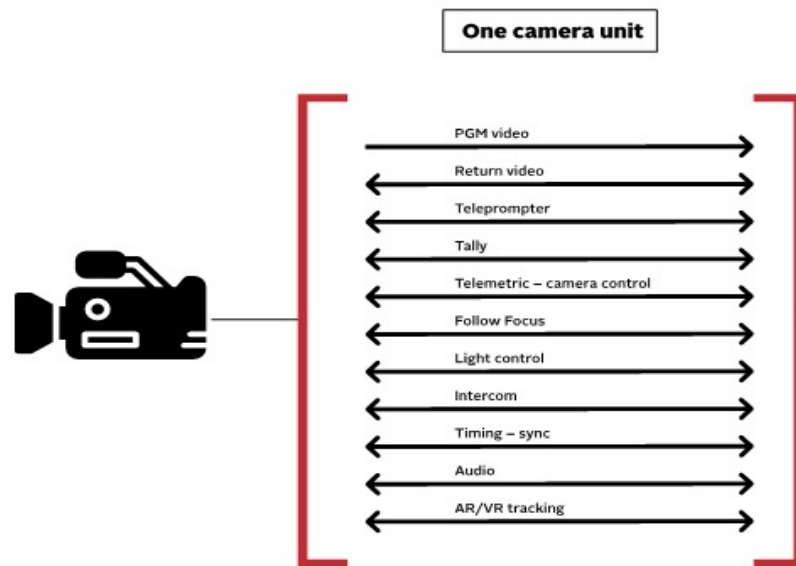


## One camera unit

- PGM video →
- Return video ←
- Teleprompter →
- Tally ←
- Telemetric – camera control →
- Follow Focus ←
- Light control →
- Intercom ←
- Timing – sync →
- Audio ←
- AR/VR tracking →



# TRADITIONAL SET-UP TO 5G ENABLED SET-UP



### 1.1.1 Non-Functional requirements

	Data	Bandwidth	Direction	Latency	Application
X	Program Video	High (>200Mbps)	uplink	Low (<20ms)	Main video output from camera
	Return Video	Medium (5-10 Mb/s)	downlink	low	Reverse video feed for monitoring
	Teleprompter	Medium (5-10 Mb/s)	downlink	low	Text feed for teleprompter
X	Tally	Very low	downlink	low	Red lights on active camera
X	Telemetry	low	Bi-directional	low	Remote controls for exposure and colour control, possible PTZ
	Follow Focus	low	downlink	low	Focus control
	Lighting control	low	downlink	low	Control onboard camera lights
	Intercom	medium	Bi-directional	low	Allows director to talk to camera op. May be 2 feeds
	Timing and sync	low	downlink		Provide timing data to camera to allow for video synchronisation and IP time stamps
	Program Audio	medium	Up link	low	Audio from any on board microphones
	AR/VR tracking	low	Bi directional	low	Positional data for virtual sets





VR sensor



DMX light



Telemetry



5G BOX



12V



Promoter



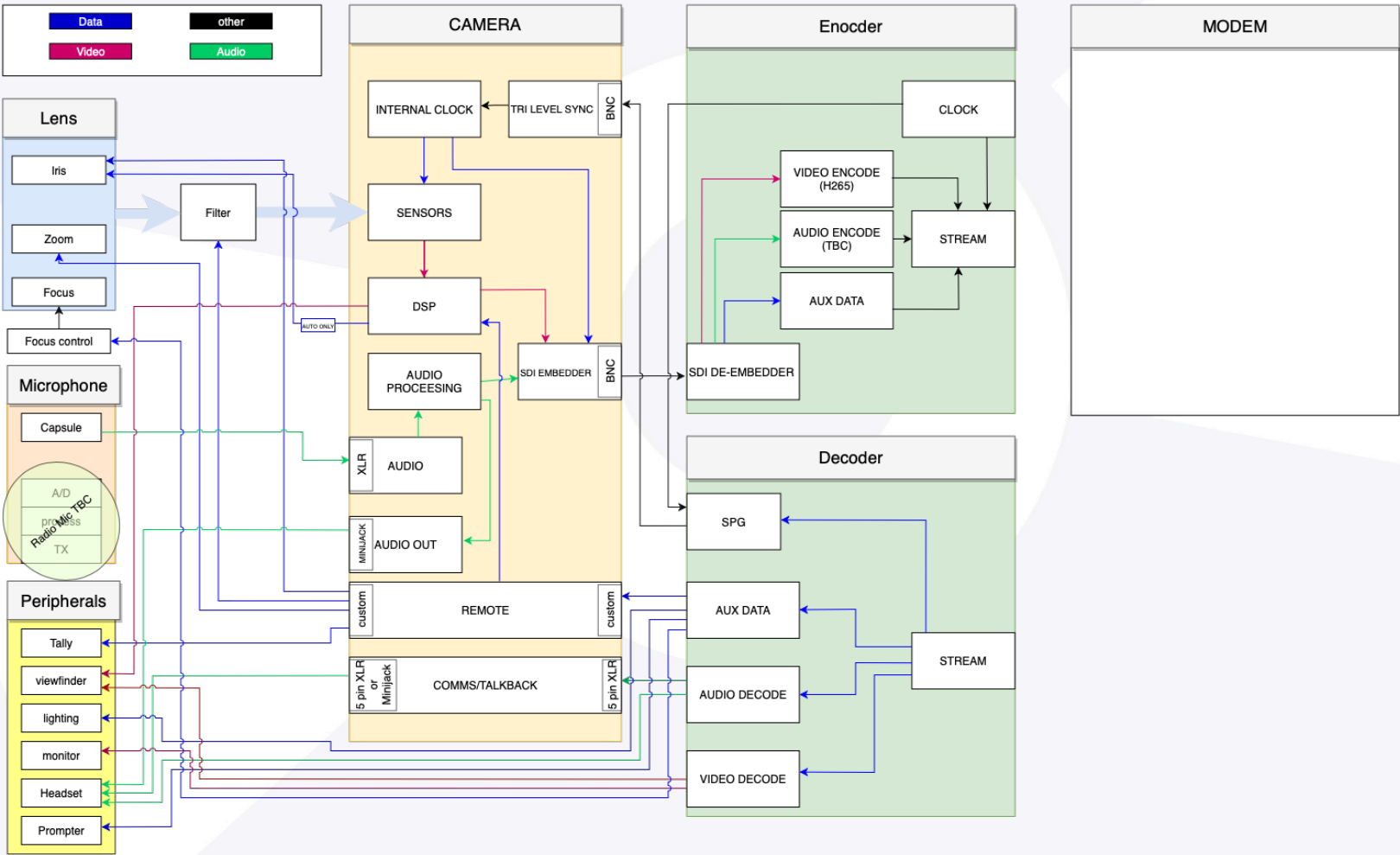
In-ear + mic



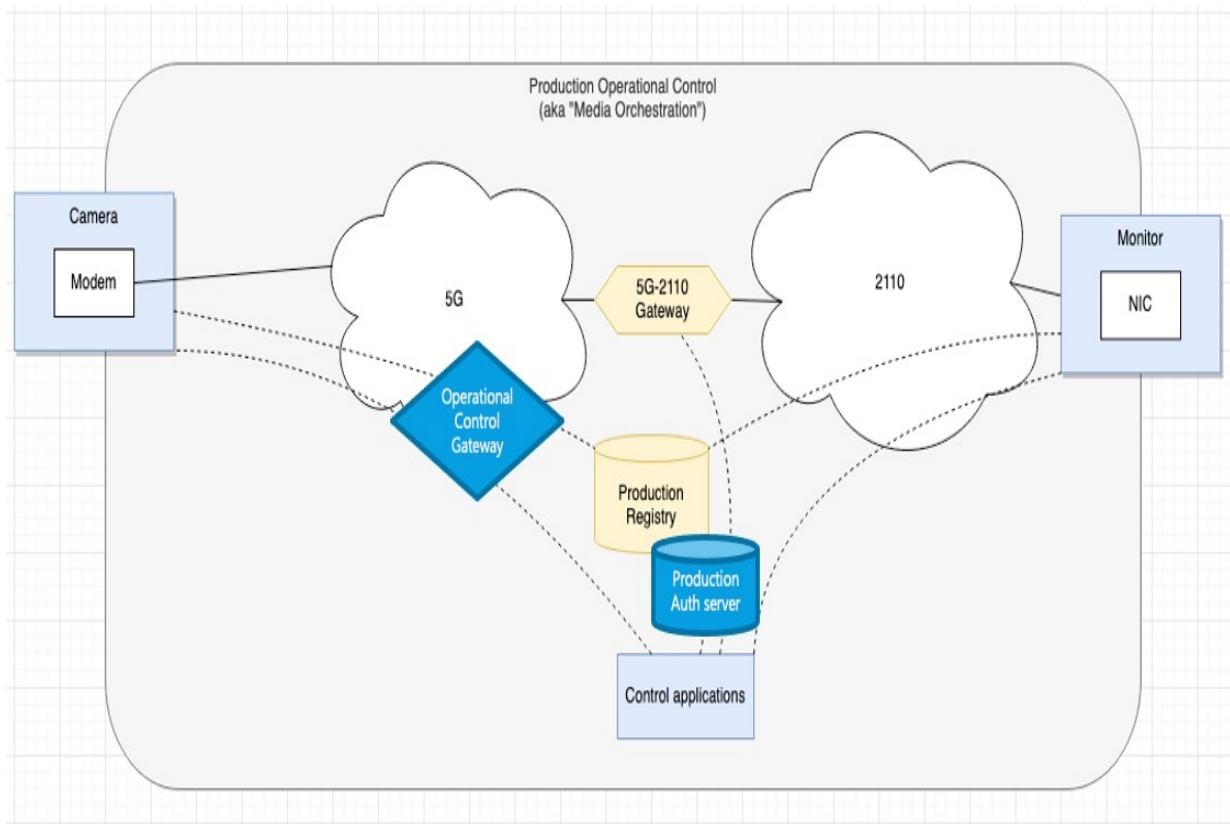
Cue system



# Functional



# MEDIA ORCHESTRATION & GATEWAY



## GATEWAY

RTP <-> ST2110

RTP <-> RIST

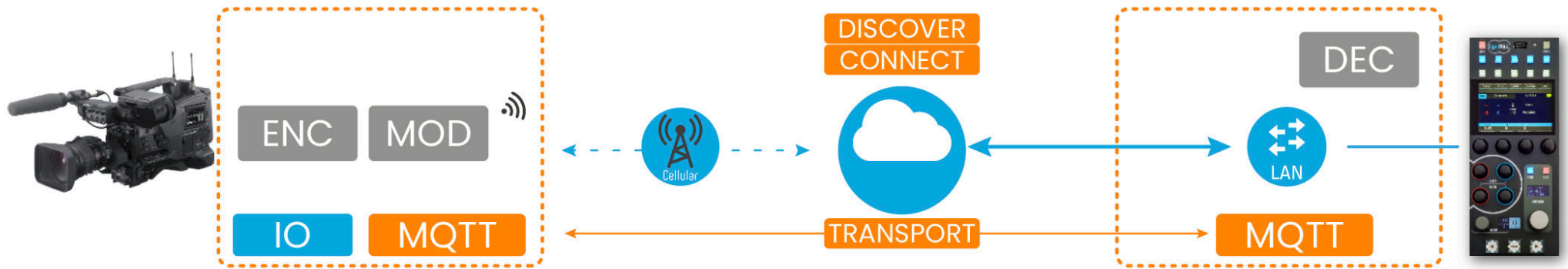
RIST <-> ST2110

RIST <-> RTP

# REMI — Remote Production Shading

Use Cases

CyanView



- \* MQTT not mandatory for a single camera but still very helpful for the flexibility and transparency
- \* Act like a local database of all telemetry
- \* Useful for inter-process communication

- \* MQTT can aggregate the telemetry of all remote nodes
- \* Controllers can subscribe and publish settings locally

# MQTT

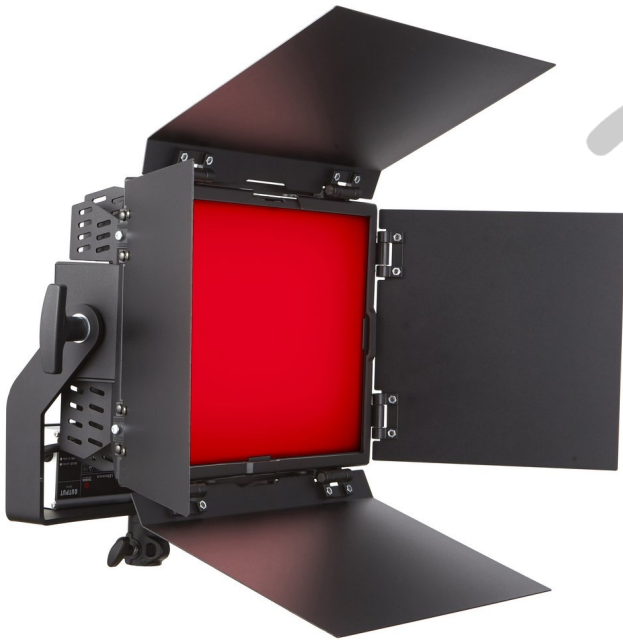
- A STANDARD THAT CAN DO MORE FOR US?

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5G  
RECORDS



TV2





# BB&S OG TELIA - NATIONALT 5G SAMARBEJDE

*5G studio LED remote control – august 2020*

