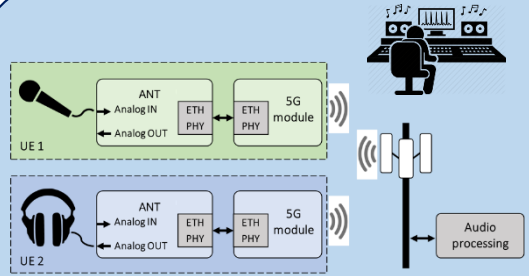
5G RECORDS

5G key technology enablers for emerging media content production services

ICT-42-2020

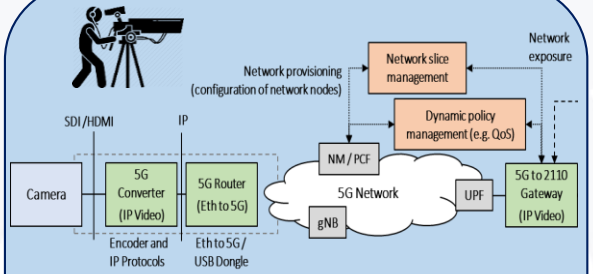
5G core technologies innovation

Live Audio Production



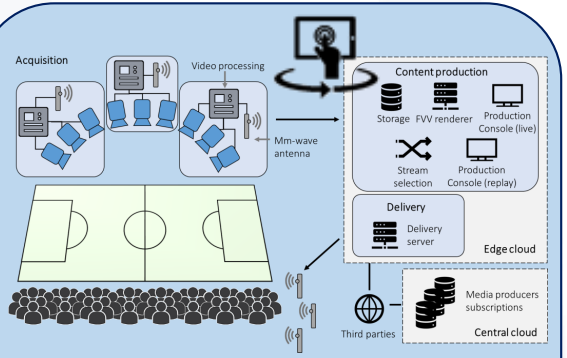
- Open and Virtualised RAN
- NR-RedCap & URLLC
- Software Defined Radio
- Dynamic Spectrum Access

Multiple Camera Wireless Studio



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

Live Immersive Media Production



- 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

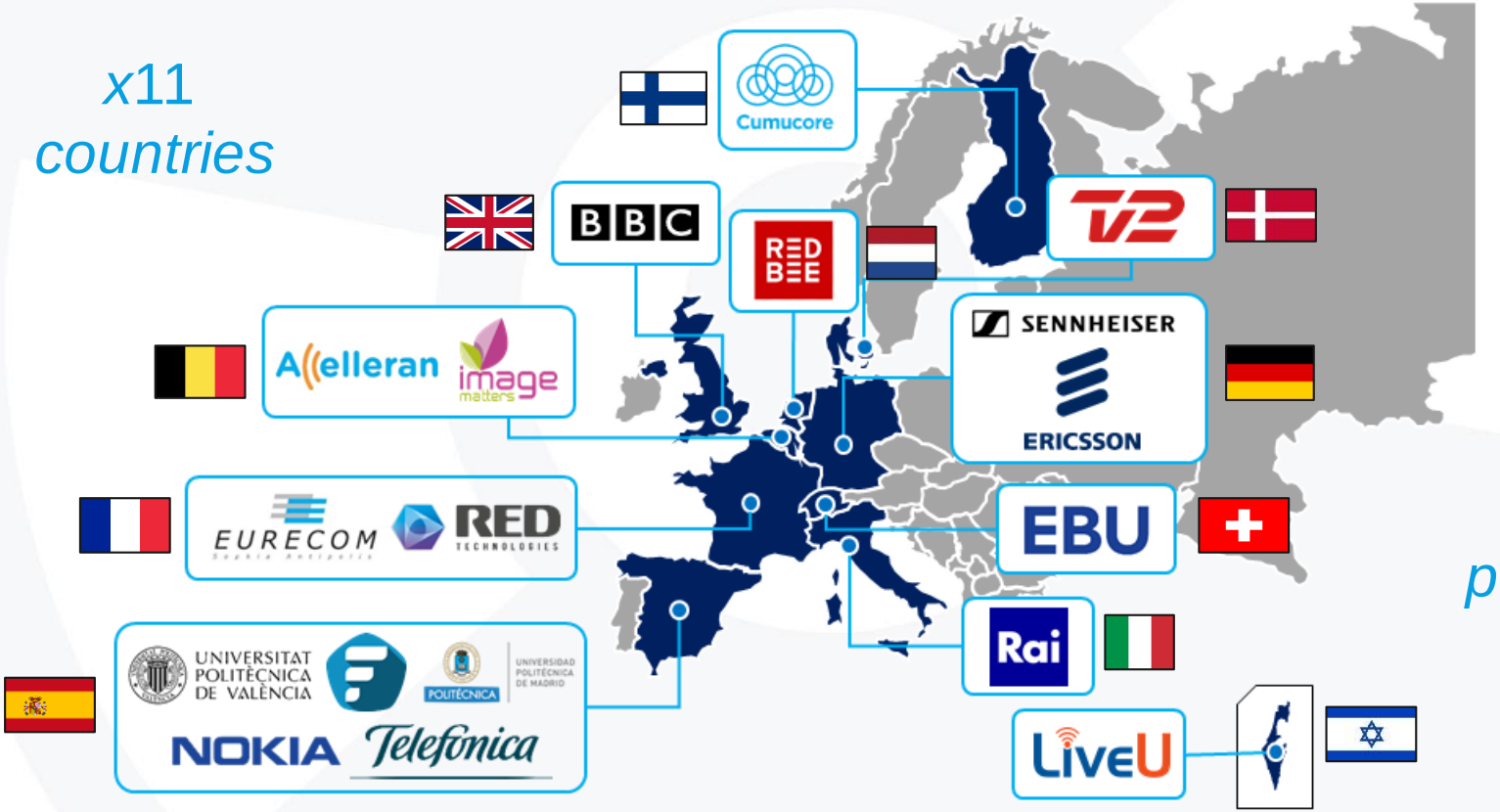
Integration
into end-to-end 5G infrastructures

Validation
in the context of real production use cases

Demonstration
of the potential value for the sector

5G RECORDS Consortium

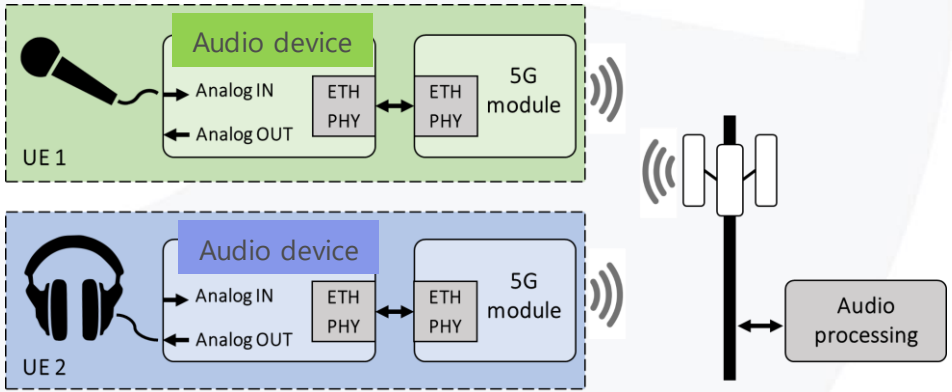
x11 countries



x18 partners

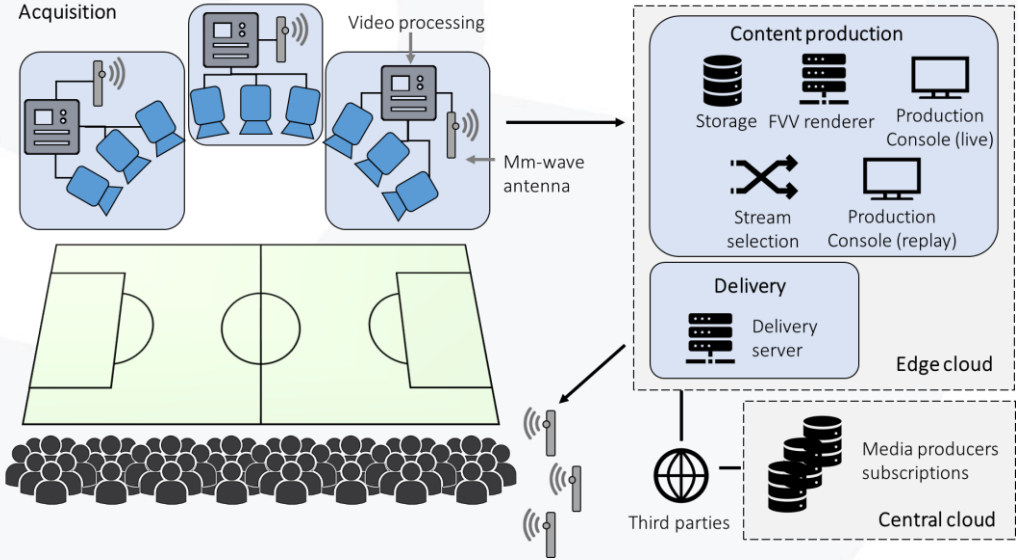
Use case Live audio production

- **Main partners**: SENNHEISER leader, Accelleran, RED TECHNOLOGIES, Cumucore, EURECOM, UNIVERSITAT POLITÈCNICA DE VALÈNCIA
- In a live audio production setup (e.g. music concerts, music festivals, TV shows), the artists are equipped with professional Programme Making and Special Events (**PMSE**) equipment
  - 5G wireless **microphones**
  - In-Ear Monitor (**IEM**) systems
  - **Control tools** and gateways between 5G and traditional audio infrastructure domains.
- **4 main areas of work**:
  - Capturing of live audio data
  - Temporary spectrum access
  - Automatic setup of wireless equipment
  - Use of a local NPN
- **Requirements**:
  - End-to-end delay < 4 ms
  - User data rate ~500 kbps
  - Synchronization of all audio sources ± 500 ns



Use case live immersive media

- **Main partners:** NOKIA leader, Telefónica, Universidad Politécnica de Madrid, Universitat Politècnica de València
- Real-time end-to-end free-viewpoint video (**FVV**) system that includes capturing, 5G contribution, virtual view synthesis on an edge server, 5G delivery and visualization on user terminals.
- The 5G connectivity allows a portable FVV system to operate in real time with reduced deployment cost and high flexibility.
- **Video workflow in 3 stages**:
  - Capturing.
  - Encoding and transmission.
  - Synthesis and visualization.
- **Requirements**:
  - Media acquisition: up to 1.5 Gbps per camera.
  - Radio uplink speeds of 20-200 Mbps.
  - Downlink speeds of 2-20 Mbps per user.
  - Connected end-users: 10-100 per 1000 m^2.
  - Reliability: 1 error every 10 min.



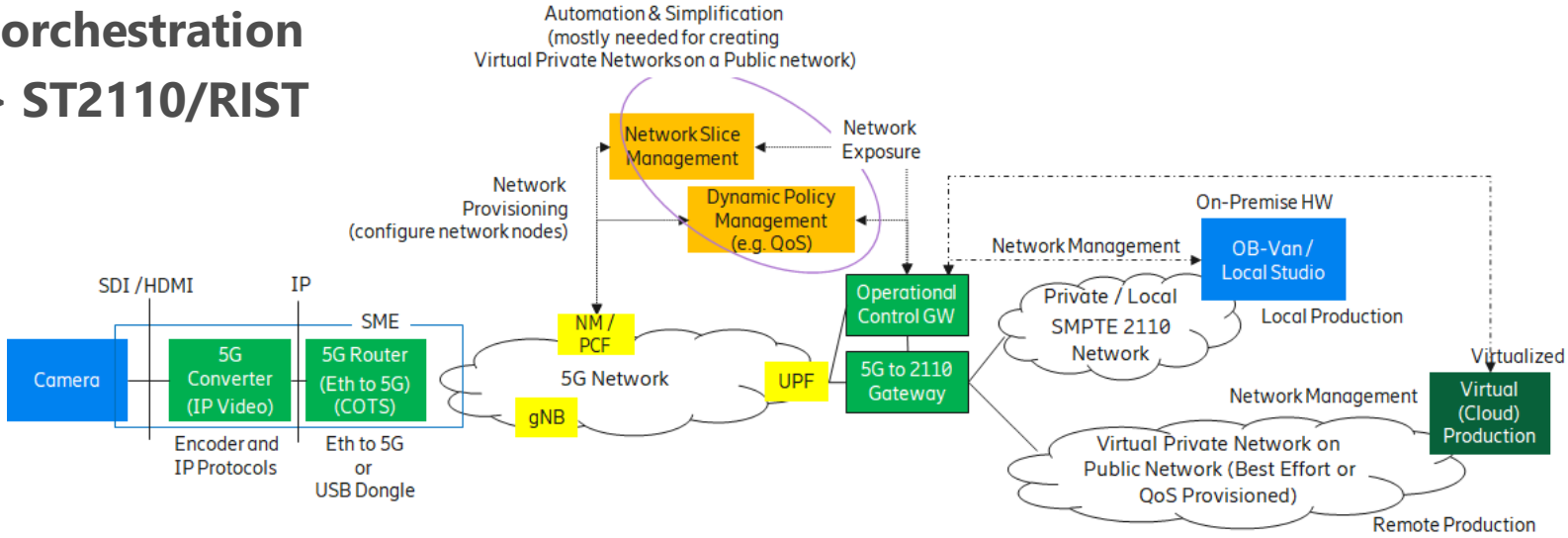
Use case Multiple camera wireless studio

Main partners:

- The best of an **IP studio** combined with the super-fast and highly reliable wireless 5G connections
- 5G will facilitate new types of workflows addressing 3 core requirements:
  - Flexibility and reduction cost in setting up productions
  - Scalability from small to large events
  - Shareability of content along the production chain and between creative stages
- **2 sub use-cases:**
  1. Multiple cameras (~5) in a wireless studio. Wired/wireless functionalities will be combined using a fully IP system
  2. Outdoor production scenario with 2 or more 5G-enabled cameras and sound capture devices connected to NPN

UC2 Multiple wireless camera - Components

- **Non-public networks**
- **Timing and synchronization**
- **Network slicing**
- **Media orchestration**
- **5G <-> ST2110/RIST**



Professional content production today

Sport events, newsgathering,etc

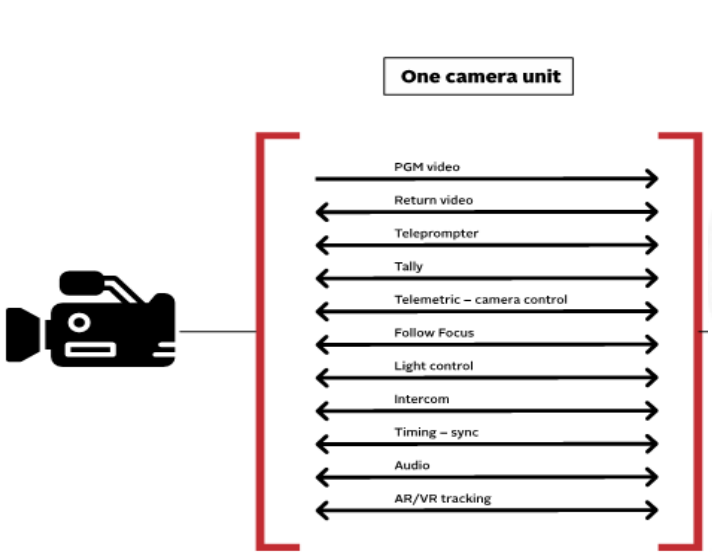
- DVB-T based transmitter:
  - Bandwidth: 30/40Mbps
  - Latency: >= 20ms
  - UHF link for the «camera» controls

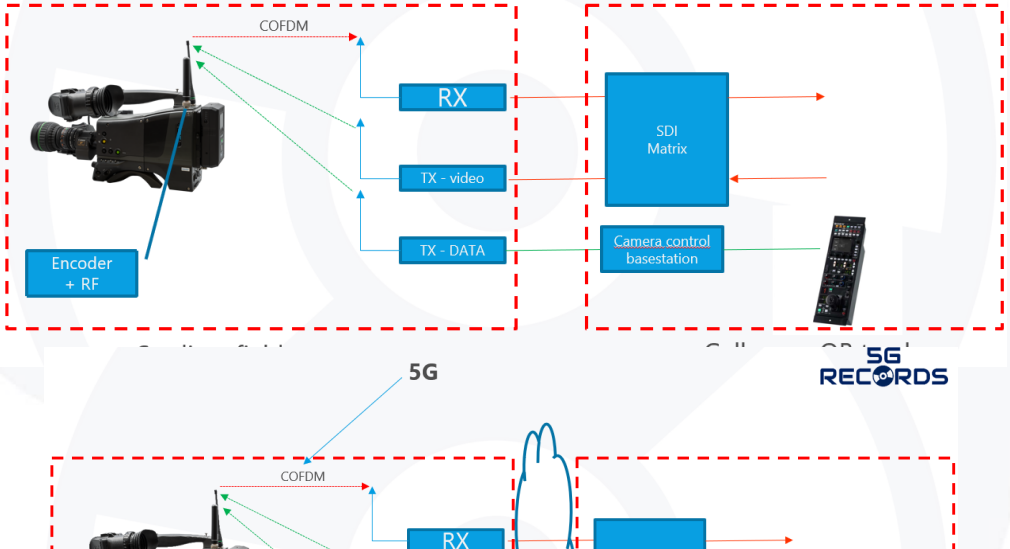
- Bonded cellular systems:
  - Bandwidth: depends from the number of aggregated modems; 30-70 Mbps
  - Latency: >=600ms-1s
  - Some of them capable to deal with return video, tally and intercom (separate solutions)
  - Plug & Play solutions

UC2 Multiple wireless camera

- **Scenario 1: Wireless cameras within a production**
  - Exploring the substitution of COFDM technologies with 5G
- **Scenario 2: Remote production over 5G**
  - Equipment on the event premises <-> production team in the gallery
    - Racking, PTZ controls, intercommunication between the crews
- **Scenario 2: Remote contribution**
  - Going beyond current bonding-based solutions
- **Exploring cloud-based MCR**

Traditional set-up to 5G enabled set-up





Codecs assessment (latency, quality and bandwidth trade-off)

- NR Midband (3.8GHz) – 100MHz: around 120Mbps – 200Mbps (uplink)
- 4-5 «wireless» cameras 5G enabled: around 30/40 Mbps each;1080p50
  - Codecs (standardized): H.264/**HEVC**
    - **JPEG-XS, VC2: at least 100Mbps**
  - Latency (enc +dec): from 30ms to 100ms depending from the configurations
    - normal latency: no restrictions on the GoP structure (I, P, B frames) →reorder on the decoder side
    - Intra ONLY: given the available bit-rate, we expect poor quality
    - IPPP…IPPP : latency and quality to be checked
    - Frame divided in multiple slices: latency should improve, quality to be checked

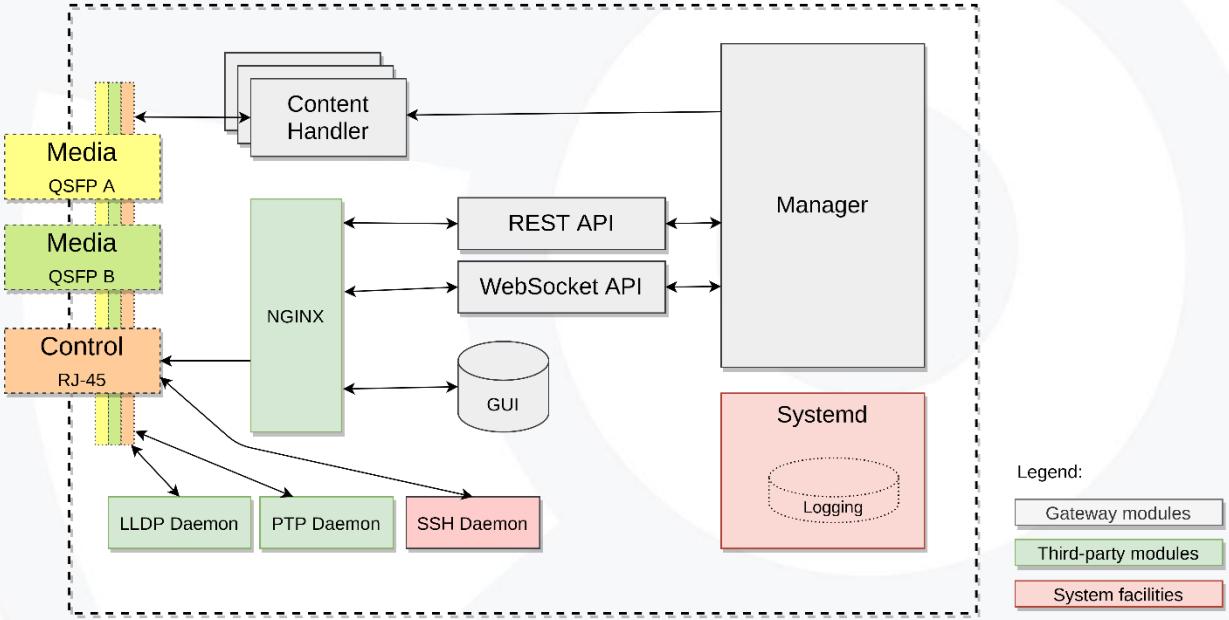
UC2 Multiple wireless camera - KPI

Remote production over 5G

Characteristic system parameter		Comment
Glass to Glass latency	20-150 ms	Latency from a image being captured by a camera to the point it becomes usable in a production gallery (discounting onward distribution
Video uplink Data Rate	> 50 Mb/s	This is to allow high quality video . different compression algorithms may be deployed depending on the format of the video
Service area	1000m^2	Typical small studio area
Mobility	≤10km/h	Support for walking speed or robotic mount
Number of Streams	Up to 5	
Jitter and latency	Constant	

…. more relaxed for the contribution scenario

Media Gateway



GATEWAY

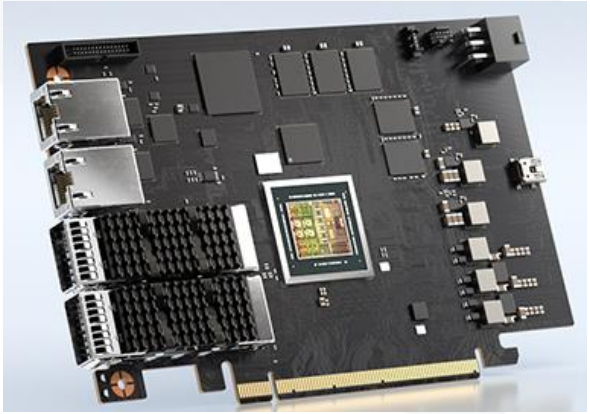
RTP <-> ST2110

RTP<->RIST

RIST <->ST2110

RIST <->RTP

Media Gateway



The Gateway is composed of two major components:
- NVIDIA Jetson AGX Xavier Development Kit [NVIDIA-Xavier]
- NVIDIA BlueField-2 DPU [NVIDIA-BlueField-2]

Next steps for UC2

- Studying/testing timing solutions for media production using 5G
- Lab tests in March @Aachen (Ericsson Lab)
  - Without the operational control layer and the gateway
- Testing the operational control layer and gateway before the end of the year
- Planning for live trials in 2022
- Interaction with 3GPP (and other SDOs)
  - **Study on Media Production over 5G NPN:** to identify standardization needs and potential standards gaps when using 5G NPN Systems for media production

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Thanks for your attention!
Any questions?

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