5G key technology enablers for emerging media content production services

*ICT-42-2020*
5G core technologies innovation

Table of contents

1. Overview
2. Consortium
   - Management structure
   - Advisory board
3. Concept
   - 5G for content production
   - 5G components
   - Technology enablers
4. Use cases
   - Live audio production
   - Multiple camera wireless studio
   - Live immersive media

1. Overview

- 5G-RECORDS is about the development, integration, validation and demonstration of **5G components** for **professional media content production**.
  - Developed within previous 5G-PPP projects and earlier R&D investments.
  - To be deployed specifically for content production.
  - Business-to-business (**B2B**) perspective.

- **3 end-to-end infrastructures**:
  - 5G Core (5GC).
  - Radio Access Network (RAN)
  - End devices.

- **3 use cases**:
  - Live audio production.
  - Multiple camera wireless studio.
  - Live immersive media production.

- **Duration**: _24 months_
  - Sept. 2020 – Aug. 2022
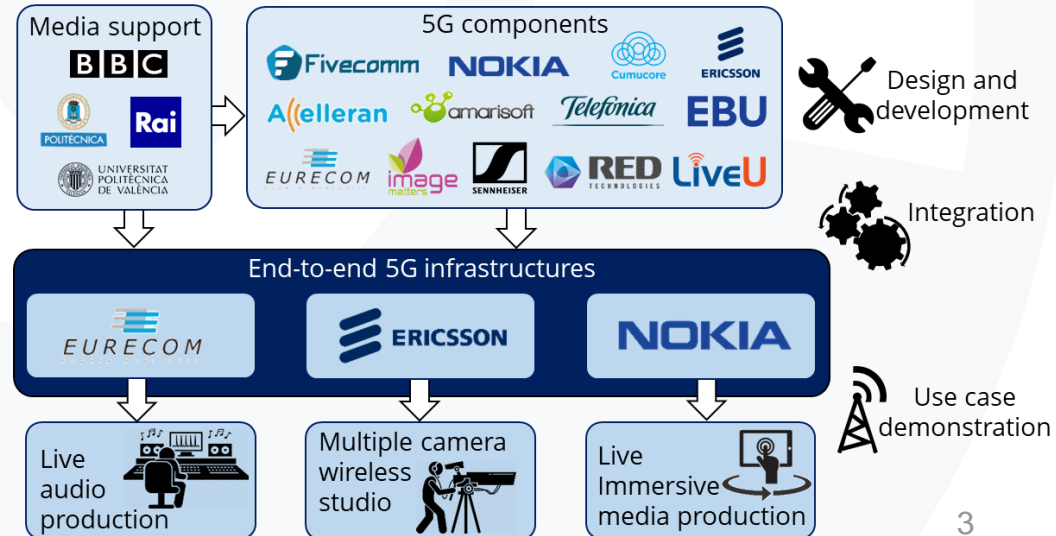
1. Overview

Main objective:

5G-RECORDS aims to develop, integrate, validate and demonstrate 5G components in end-to-end 5G infrastructures for professional AV media content production.

Specific objectives:

1. *Design* and develop 5G components based on 3GPP Rel-15, 16 and beyond.

2. *Integrate* the developed 5G components into end-to-end 5G infrastructures.

3. *Validate* the 5G components in the context of the considered use cases.

4. *Demonstrate* the potential value that 5G brings to the content production sector.

5. *Maximize* the impact of the project results and influence standardisation and regulation bodies through test-beds, demonstrations and technical solutions.

2. Consortium

10 countries **18 partners**

🇧🇪	Accelleran, Image Matters
🇫🇮	Cumucore
🇫🇷	Eurecom, RED Technologies
🇩🇪	Ericsson, IRT, Sennheiser
🇮🇱	LiveU
🇮🇹	RAI
🇪🇸	Fivecomm, Nokia, Telefonica, UPM, UPV
🇨🇭	EBU
🇬🇧	BBC
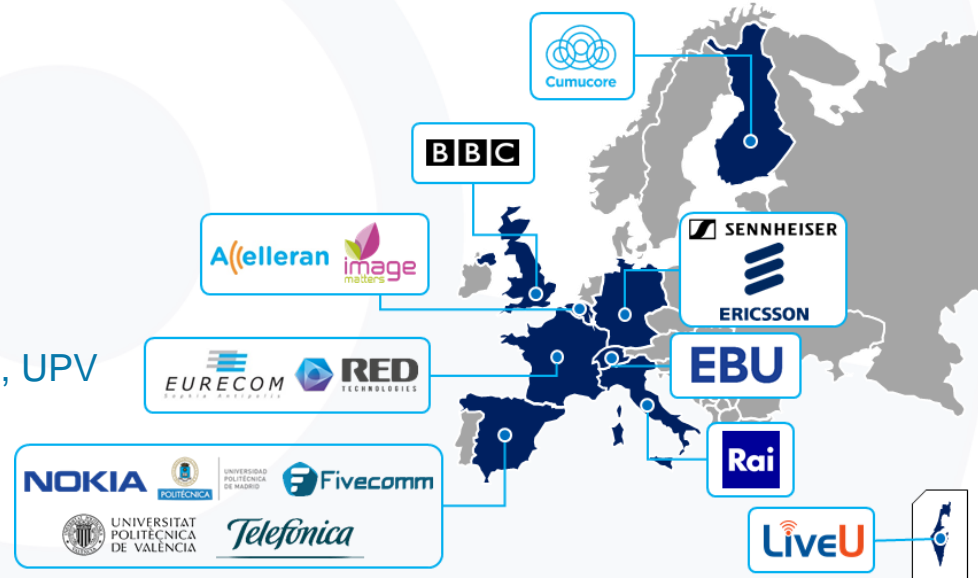
- 7 high-tech SMEs (*41.2%*) – 2 5G infrastructure providers - 1 MNO - 2 media vendors 3 broadcasters - 3 research centres and universities.

2. Consortium: Management Structure

- The management structure is formed by 3 entities:
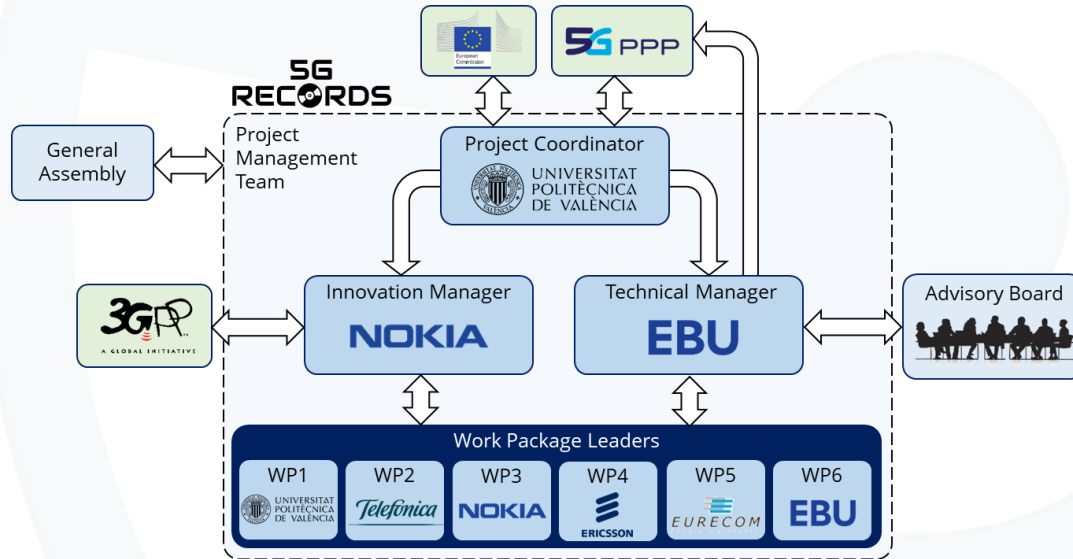
1. Project management team:
   – Project Coordinator   **UPV**
   – Technical Manager   **EBU**
   – Innovation Manager   **Nokia**
   – Work Package Leaders
2. General Assembly
3. Advisory Board

- Project coordinator → 5G-PPP Steering Board representative.
- Technical manager → 5G-PPP Technology Board representative.

2. Consortium: Advisory Board

- Strong support of companies from both 5G and content production worlds:

7 countries **8 companies**

🇫🇷	Amarisoft
🇩🇪	SWR, ZDF
🇳🇴	Nevion
🇪🇸	RTVE
🇨🇭	5G-MAG
🇳🇱	NEP
🇬🇧	BT Sport

- Objectives:
  - Provide feedback to partners on the use cases and 5G ecosystem.
  - Attend physical meetings and participate in trials on an invitation basis.
- The AB remains open.
  - More companies could join if approved in the General Assembly.

3. Concept: 5G for content production

- 5G may enable new ways of producing and transmitting AV media content to the end users, opening up **new opportunities** across the value chain.
  - 5G networks currently are in deployment stages.
  - Media and broadcasting providers are already exploring the possibilities of using such networks for content production.

- 5G-RECORDS will study the **technological improvements** that underpin the 5G opportunity.

- Professional content production requires specific QoS and timing parameters (**uplink**):
  - Very high **data rates** for video sources.
  - Low **latency** in particular for audio signals.
  - Very high **reliability** (i.e. very low packet loss rates and/or jitter).
  - Extremely precise **synchronicity**.
  - Stringent content **security** measures dictated by the high value of the content

- If 5G were able to meet the requirements, it may enable new and more efficient ways of professional content production.

3. Concept: 5G components

- The **5G components that partners bring to the project are:**

NOKIA	5G mm-wave antennas
Telefónica	Edge computing
Cumucore	Compact 5GC, network slicing
RED TECHNOLOGIES	Spectrum sharing
LiveU image matters	5G-enabled bonded cellular

EBU	SMPTE 2110 – 5G Gateway
Rai	5G media equipment
EURECOM Sophia Antipolis	5G modems and infrastructure
A((elleran	Virtual RAN solution
SENNHEISER	Microphones / In-ear-monitoring

3. 5G Technology Enablers

Non-public networks

Exclusive mobile networks that enable to use resources independently of other users, due to their exclusive use.

Network slicing

Enables a dedicated part of the network to be made available for a dedicated set of users. Different network slices are tailored to specific use cases.

Edge computing

Key technology for real-time processing capabilities at the edge of the network, guaranteeing specific requirements.

Open and virtualised RAN

Open and interoperable interfaces, complementary to 3GPP, supporting a multi-vendor ecosystem for future intelligent 5G vRAN platforms.

NR-Lite air interface

New air interface to address specific use cases with lower latency, longer battery life and wider coverage than NB-IoT.

Dynamic spectrum access

Process of increasing spectrum efficiency and network capacity via the real-time adjustment of radio resources.

Mm-wave antennas/devices

New radio bands between 30-300 GHz, based on line-of-sight paths, to provide extreme capacity for the busiest locations.

Orchestration

Professional media applications require the development of an additional orchestration layer above the 5G infrastructure capabilities.

4.1 Use case 1: Live audio production

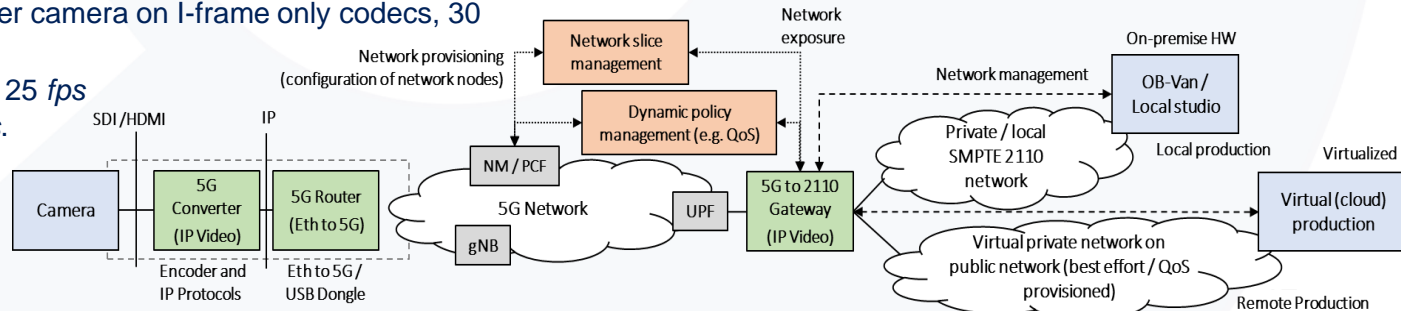- **Main partners**: SENNHEISER *leader* A((elleran RED TECHNOLOGIES Cumucore EURECOM Sophia Antipolis UNIVERSITAT POLITÈCNICA DE VALÈNCIA

- 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.

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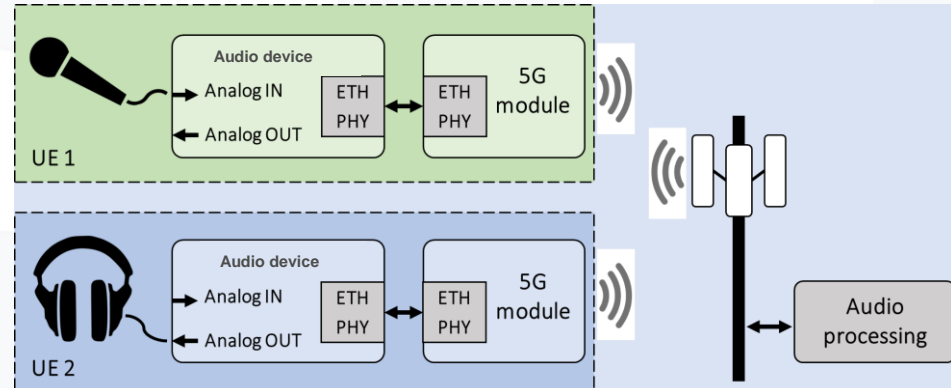
4.2 Use case 2: Multiple camera wireless studio

- **Main partners:** ERICSSON *leader* LiveU EBU BBC image matters Rai Cumucore Fivecomm UNIVERSITAT POLITÈCNICA DE VALÈNCIA

- 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.

- **Requirements:**
  - Bandwidth: 200-400 Mbps per camera on I-frame only codecs, 30 Mbps per camera.
  - Latency: less than 40 ms for 25 *fps* or less than 20 ms for 50 *fps*.
  - Low reliability is expected.
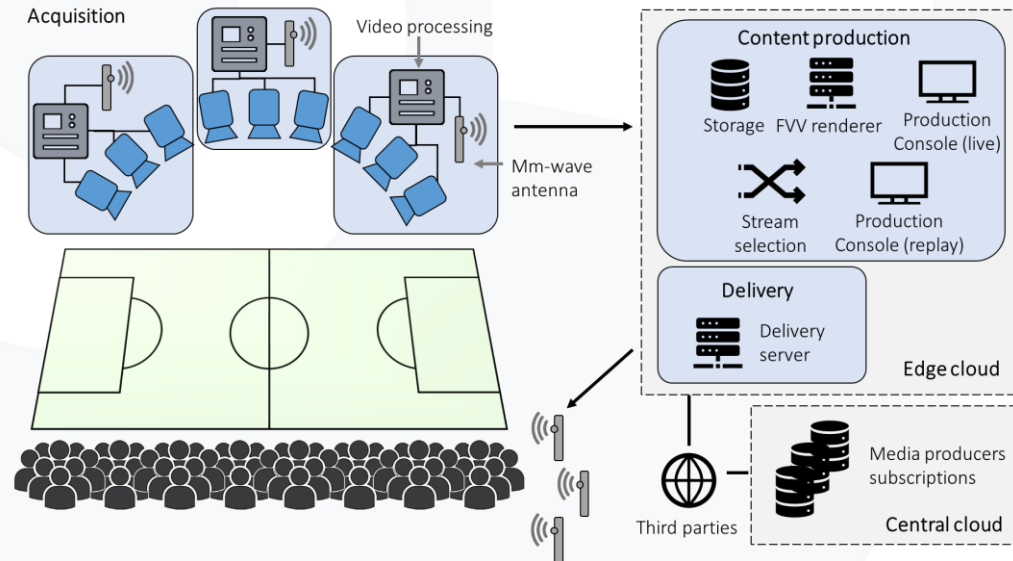
4.3 Use case 3: live immersive media

- **Main partners:** NOKIA *leader* Telefónica POLITÉCNICA 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.

Thank you