5G RECORDS

5G Wireless Studio

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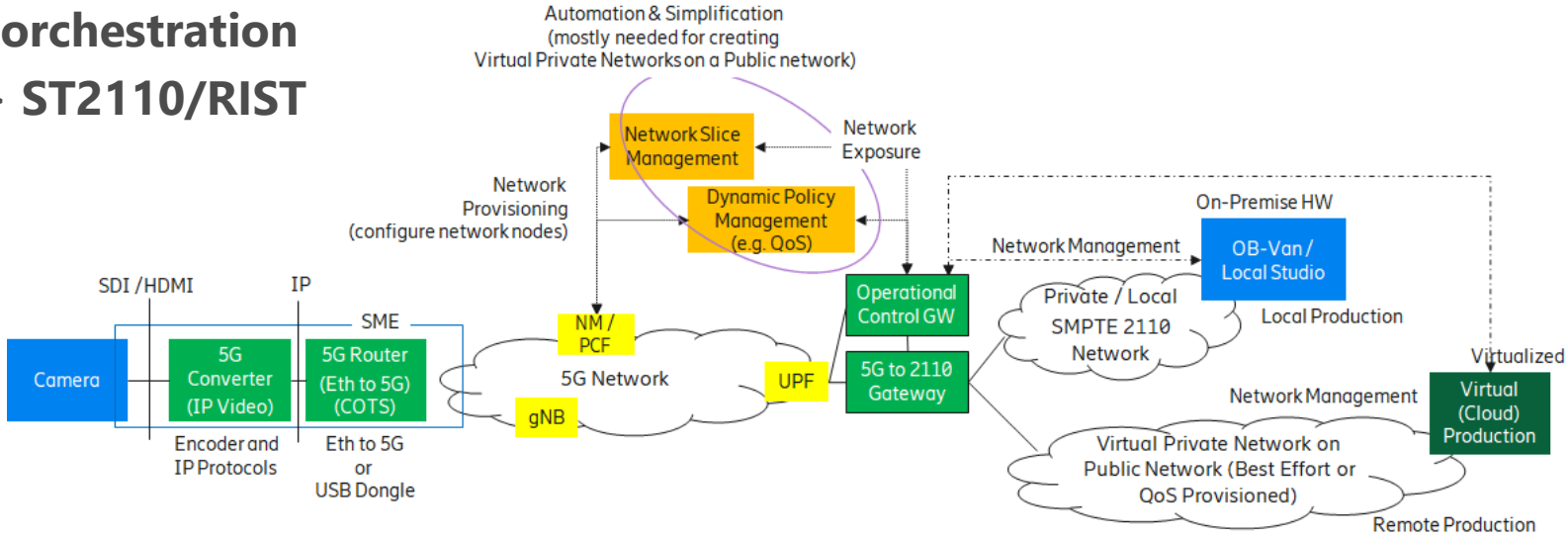
Use case Multiple camera wireless studio

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

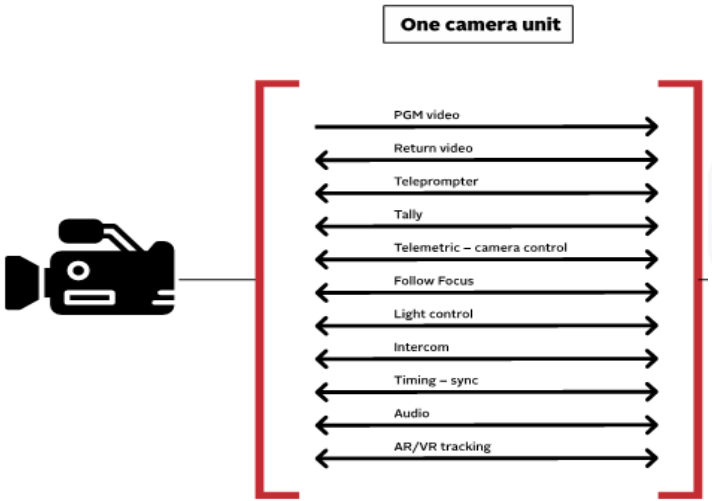
Sport events, newsgathering,etc

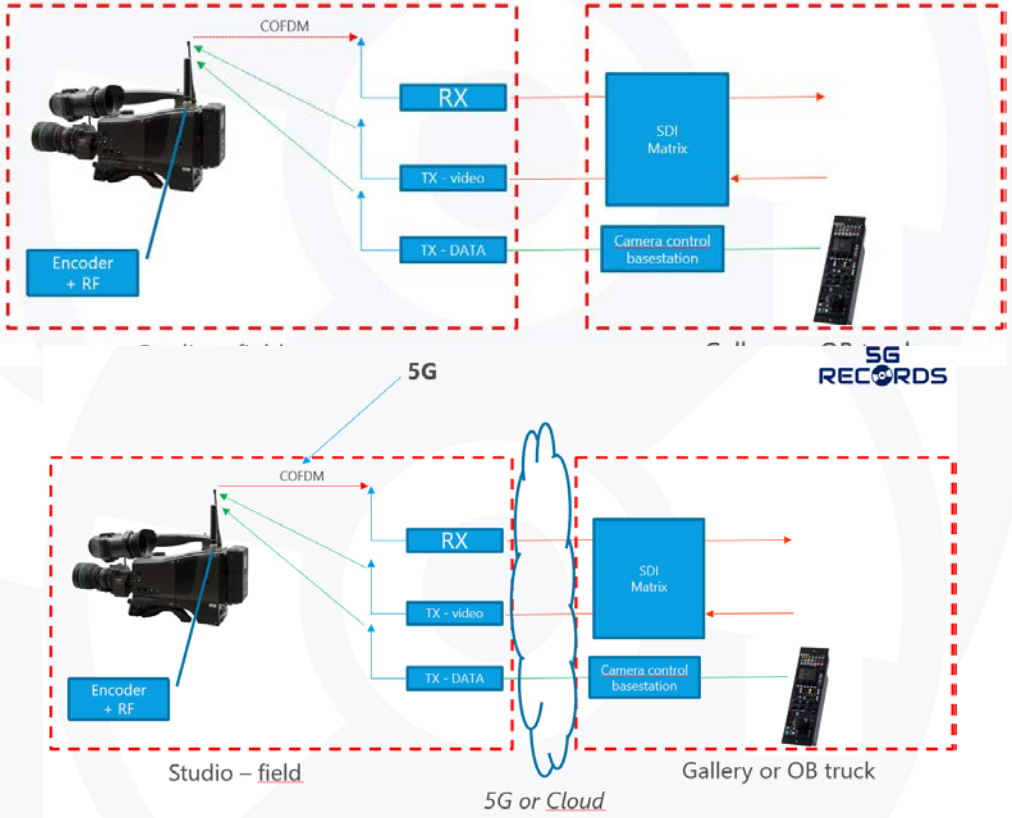
- DVB-T based transmitter:
  - Bandwidth: 30/40Mbps
  - Latency: >= 20ms
  - UHF link for the «camera» controls
- Bonded cellular systems:
  - Bandwidth: depends from the number of aggregated modems; 30-70 Mbps
  - Latency: >=700ms-1s
  - Some of them capable to deal with return video, tally and intercom (separate solutions)
  - Plug & Play/vendor lock-in

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

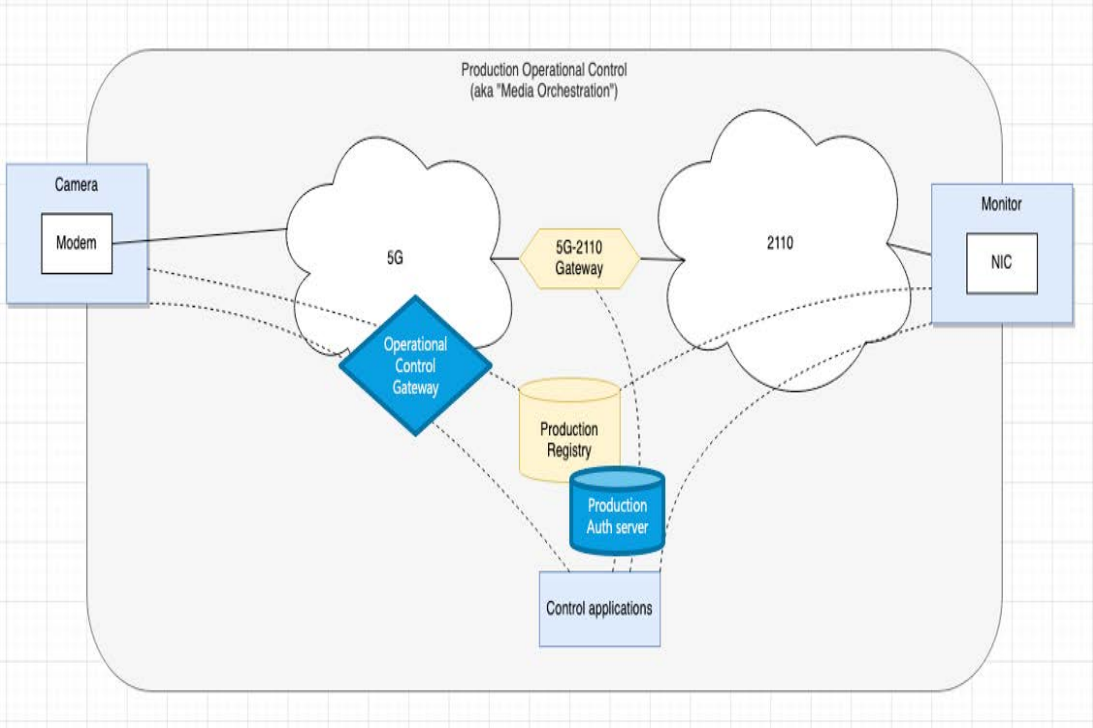
UC2 Multiple wireless camera - KPI

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 Orchestration & Gateway



GATEWAY

RTP <-> ST2110

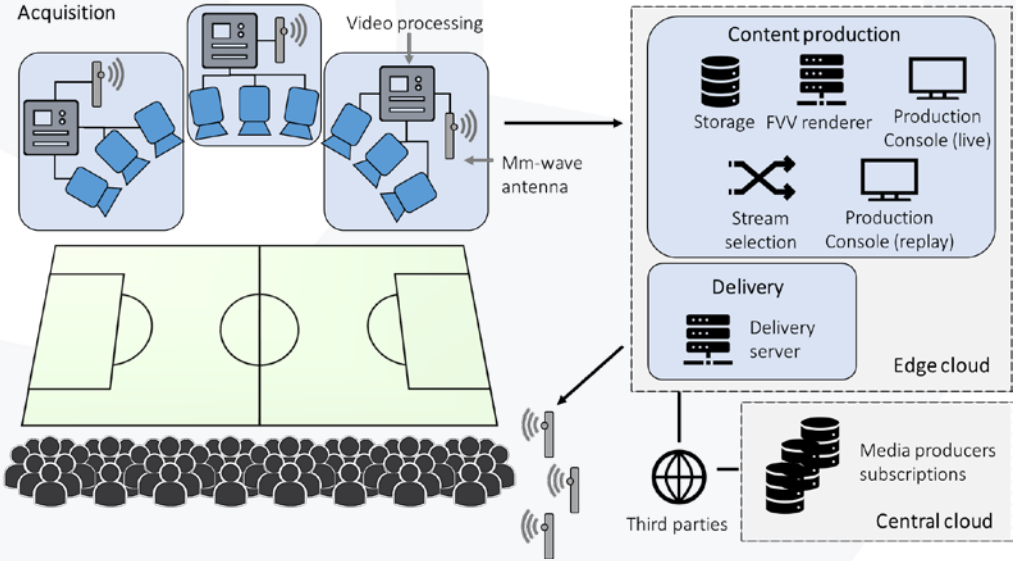
RTP<->RIST

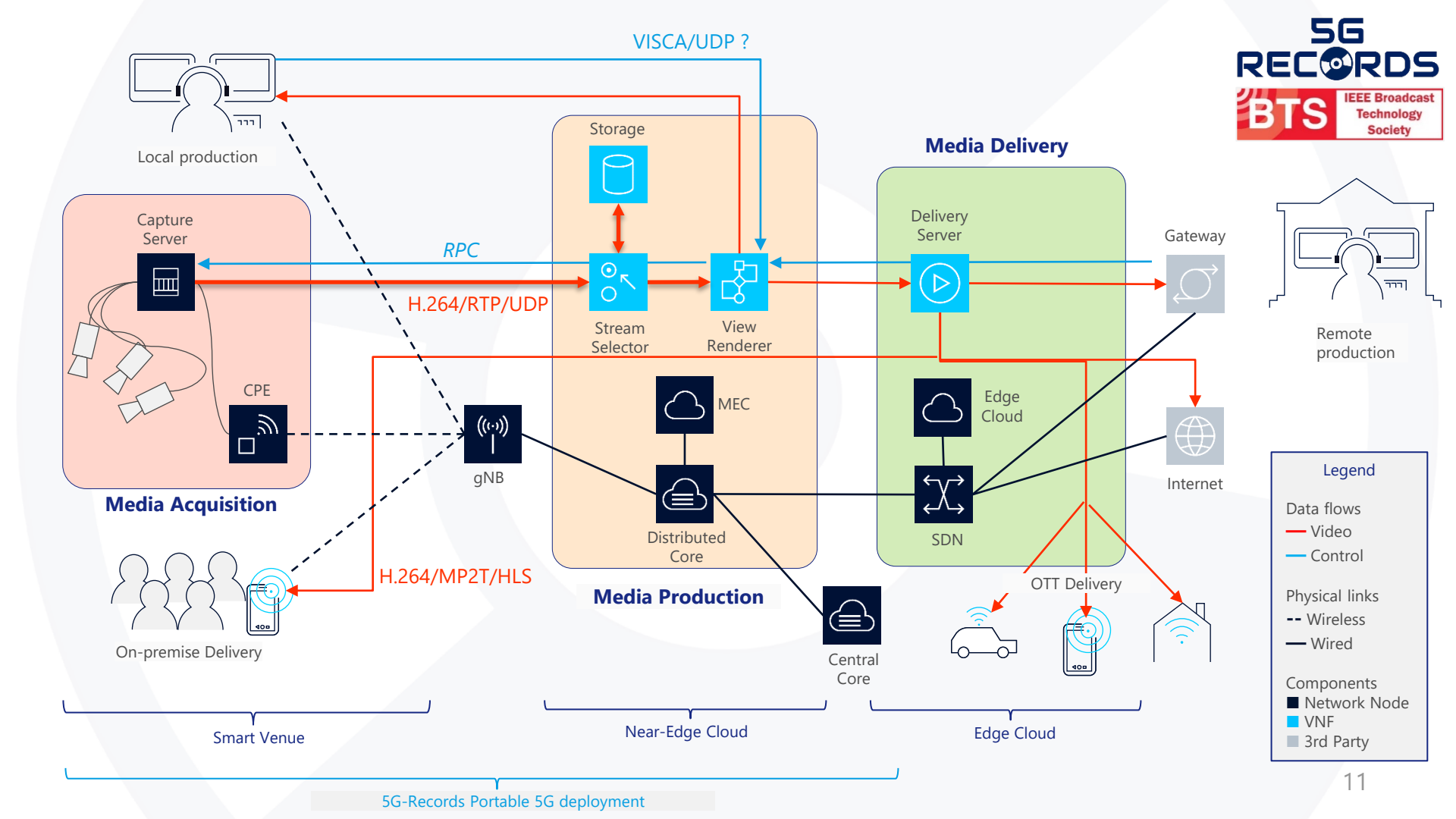
RIST <->ST2110

RIST <->RTP

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 200 Mbps 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.




VISCA/UDP ?
Local production
Storage
Media Delivery
Capture Server
RPC
H.264/RTP/UDP
Stream Selector
View Renderer
Delivery Server
Gateway
Remote production
CPE
MEC
Edge Cloud
gNB
Internet
Media Acquisition
Distributed Core
SDN
H.264/MP2T/HLS
Media Production
OTT Delivery
On-premise Delivery
Central Core
Legend
Data flows
Video
Control
Physical links
Wireless
Wired
Components
Network Node
VNF
3rd Party
Smart Venue
Near-Edge Cloud
Edge Cloud
5G-Records Portable 5G deployment

FVV Content Production Scenarios

- FVV operates as a “virtual camera” which can be integrated in the production workflow
- Requirements depend strongly on scene complexity --> 2-step approach

Scenario		Simple	Advanced
Real scene	Lighting	Controlled (indoor)	
	Complexity	Low: few objects and occlusions, short depth range	High: many objects and occlusions, wide depth range
Virtual viewpoint characteristics	Selection	By camera operator, in real time	
	Range (angle)	Narrow	Wide
	# DOFs (example)	1 (within arc defined by reference cameras)	2 (also forward and backward)
Network requirements	Bitrate	~50 Mbps/cam	~100 Mbps/cam
	Latency	< 170 ms	< 170 ms

Next steps

- 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 – one for each use-case
- 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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