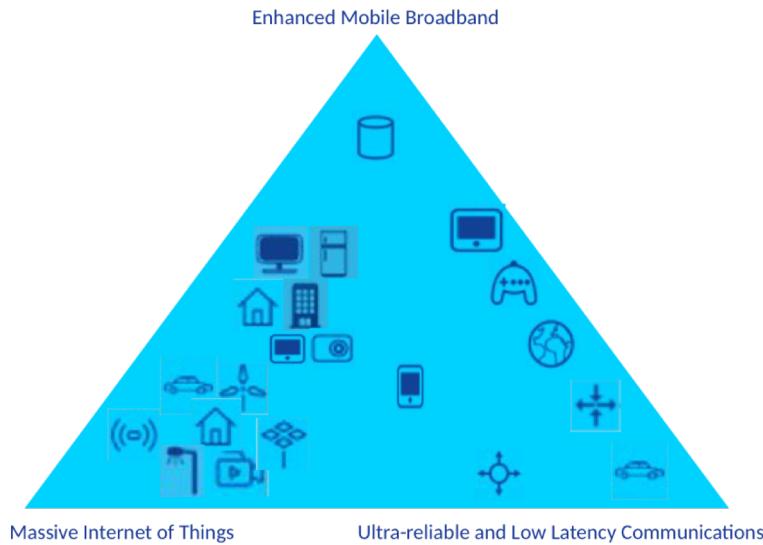


# 3GPP achievements on VR & ongoing developments on XR over 5G

Gilles Teniou  
3GPP SA4 Vice-Chairman  
Orange

# 5G VISION

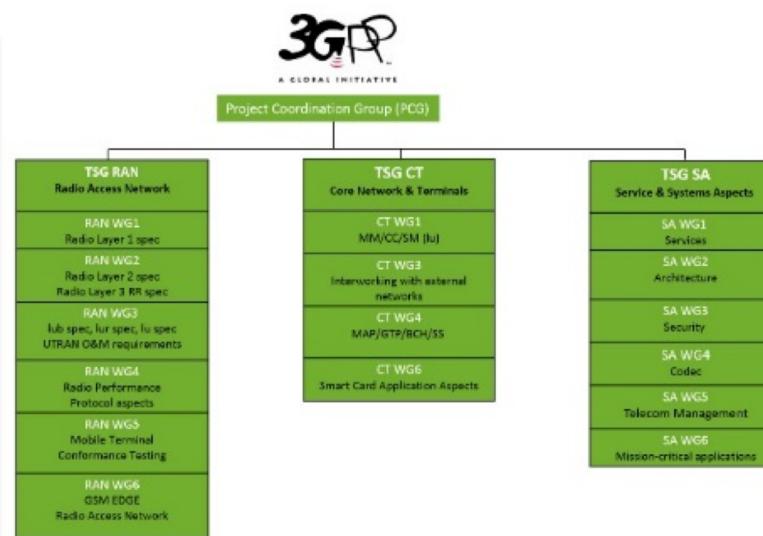
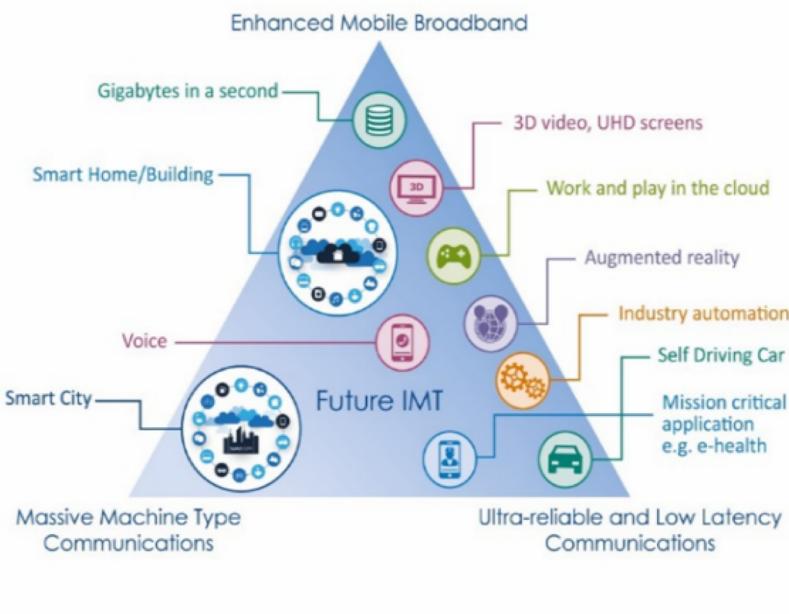


## 5G / IMT-2020 VISION

- Address demands and business contexts of 2020 and beyond.
- Enable a fully mobile and connected society.
- Empower socio-economic transformations in countless ways.

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# From the vision to standards



3GPP SA4 addresses the media distribution and codecs aspects such as audiovisuals and conversational services

## 3GPP Specifications and Reports:

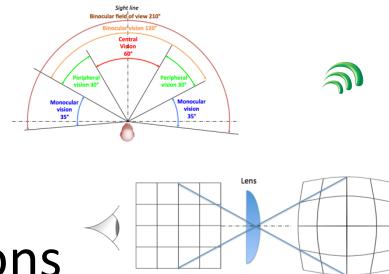
Requirements	21 series
Service aspects ("stage 1")	22 series
Technical realization ("stage 2")	23 series
Signalling protocols ("stage 3") - user equipment to network	24 series
Radio aspects	25 series
<b>CODECs</b>	<b>26 series</b>
Data	27 series
Signalling protocols ("stage 3") - (RSS-CN) and OAM&P and Charging (overflow from 32.- range)	28 series
Signalling protocols ("stage 3") - intra-fixed-network	29 series
Programme management	30 series
Subscriber Identity Module (SIM / USIM), IC Cards. Test specs.	31 series
OAM&P and Charging	32 series
Security aspects	33 series
UE and (U)SIM test specifications	34 series
Security algorithms	35 series
LTE (Evolved UTRA), LTE-Advanced, LTE-Advanced Pro radio technology	36 series
Multiple radio access technology aspects	37 series
Radio technology beyond LTE	38 series

# Checkpoint on VR (360)

## April 2016 – June 2017: Study on Virtual reality

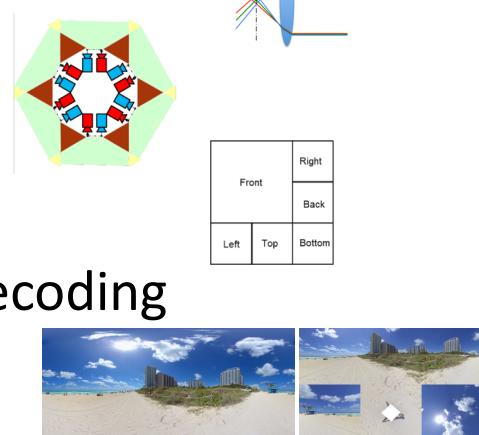
### Video systems

- Human factors
- FOV and lenses
- Optical aberrations



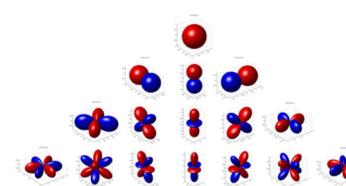
### VR Video Workflow

- Capture
- Stitching
- Projection
- Packing
- Encoding/decoding
- Rendering



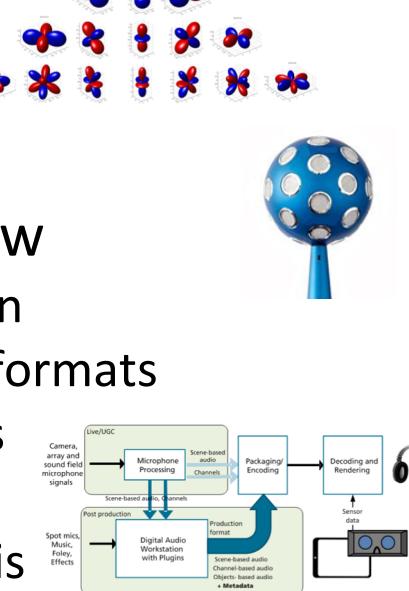
### Audio systems

- Channel based
- Object based
- Scene based



### VR Audio Workflow

- Content production
- Audio production formats
- Rendering systems
- Data exchange
- Ambisonics analysis
- Rendering



3GPP  
TR 26.918

Virtual Reality  
(VR)  
media services  
over 3GPP

# Checkpoint on VR (360)

- Release 15 Technical specification for streaming services
  - Definition of **client architecture** and **API** for VR streaming services
  - Set of **operating points** covering the large range of device capabilities from Carboards to high-end tethered HMDs.
  - Definition of **Media profiles**: mapping of operating points to DASH delivery
  - System metadata** is added to support rendering of 360 experiences on 2D screens, including the aspects of rendering without pose information



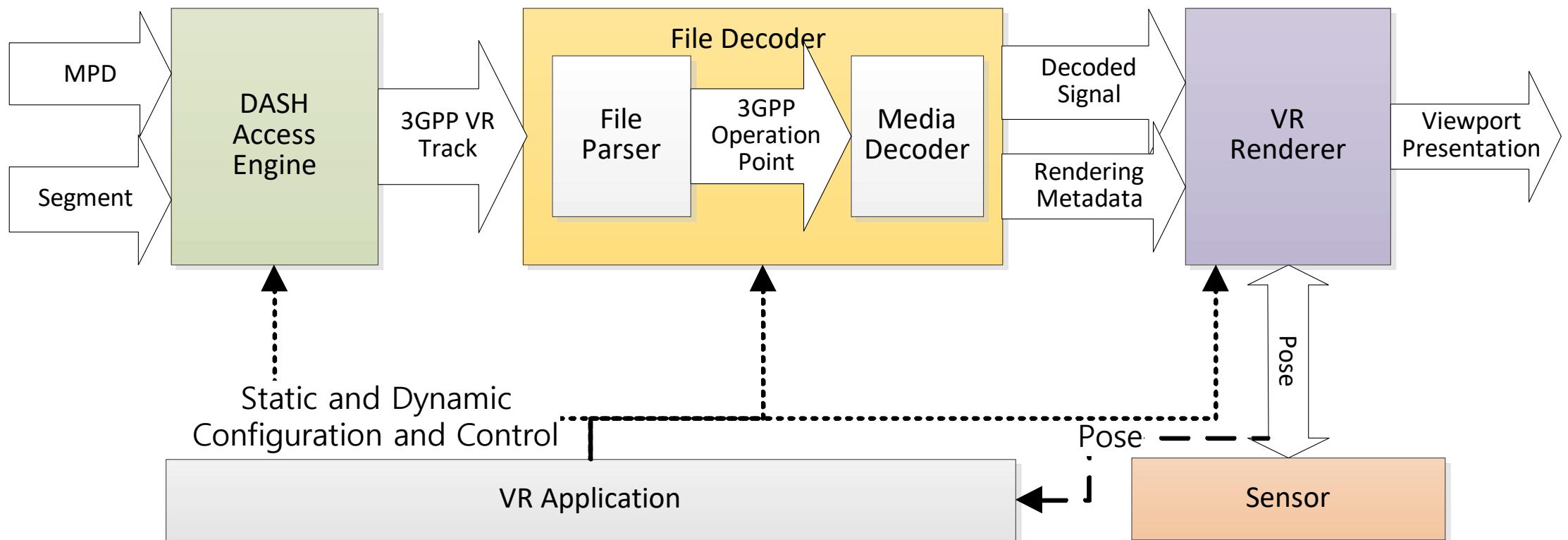
3GPP  
TS 26.118

Virtual Reality  
profiles for  
streaming  
applications

# Checkpoint on VR (360) - TS 26.118



## VR Streaming client architecture and API

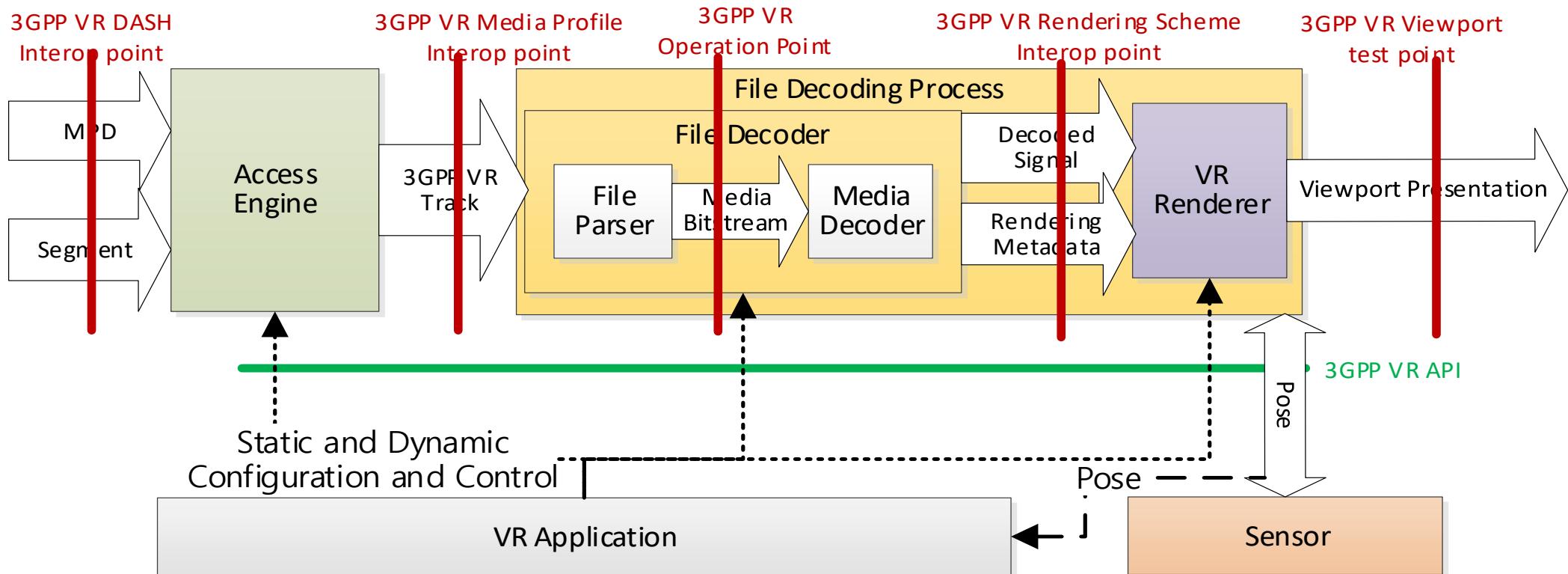


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# Checkpoint on VR (360) - TS 26.118



## VR Streaming client architecture and API



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# Checkpoint on VR (360) - TS 26.118



## Video Operating points

- **Basic:** Based on **H.264/AVC** High Profile Level 5.1 for **mono** only, single stream, and reuse of single DASH adaptation set.
- **Main:** Based on **H.265/HEVC** High Profile Level 5.1 allowing mono and **stereo**, single stream, but either a single or **multiple independent Adaptation Sets** may be offered, such that a client can choose based on its current pose.
- **Flexible:** based on **H.265/HEVC** High Profile Level 5.1, but in addition to the Main Video features, it permits to **stream and combine multiple tiles** at the receiver for improved quality.

Operation Point name	Decoder	Bit depth	Typical Original Spatial Resolution	Frame Rate	Colour space format	Transfer Characteristics	Projection	Rotation	RWP	Stereo
Basic H.264/AVC	H.264/AVC HP@L5.1	8	Up to 4k	Up to 60 Hz	BT.709	BT.709	ERP w/o padding	No	No	No
Main H.265/HEVC	H.265/HEVC MP10@L5.1	8, 10	Up to 6k in mono and 3k in stereo	Up to 60 Hz	BT.709 BT.2020	BT.709	ERP w/o padding	No	Yes	Yes
Flexible H.265/HEVC	H.265/HEVC MP10@L5.1	8, 10	Up to 8k in mono and 3k in stereo	Up to 120 Hz	BT.709 BT.2020	BT.709, BT.2100 PQ	ERP w/o padding CMP	No	Yes	Yes

# Checkpoint on VR (360) - TS 26.118



- » **Audio Operating point**
- » **MPEG-H 3D Audio Baseline profile.** This technology enables the distribution of channel, object and scene-based 3D audio.
  - Additional interesting technologies enabling the distribution of channel, object and scene-based 3D audio were considered, and the characterization results of all proposed technologies are documented in **TR 26.818**.

# Extended Reality over 5G

## ⚡ Study Item launched in July 2018

### ⚡ Extended Reality (XR)

- an envelope that includes
  - VR (Virtual Reality)
  - AR (Augmented Reality)
  - MR (Mixed Reality)

### ⚡ The study addresses:

- VR cases in more than 360° navigation
  - 3DOF+ 3 axis rotations + 3 axis translations limited to head movement with fixed body
  - 6DOF Full free navigation (user can walk and look around)
- AR cases where synthetic objects are overlaid with the real environment
- MR cases where those synthetic additions are meant to be part of the real world

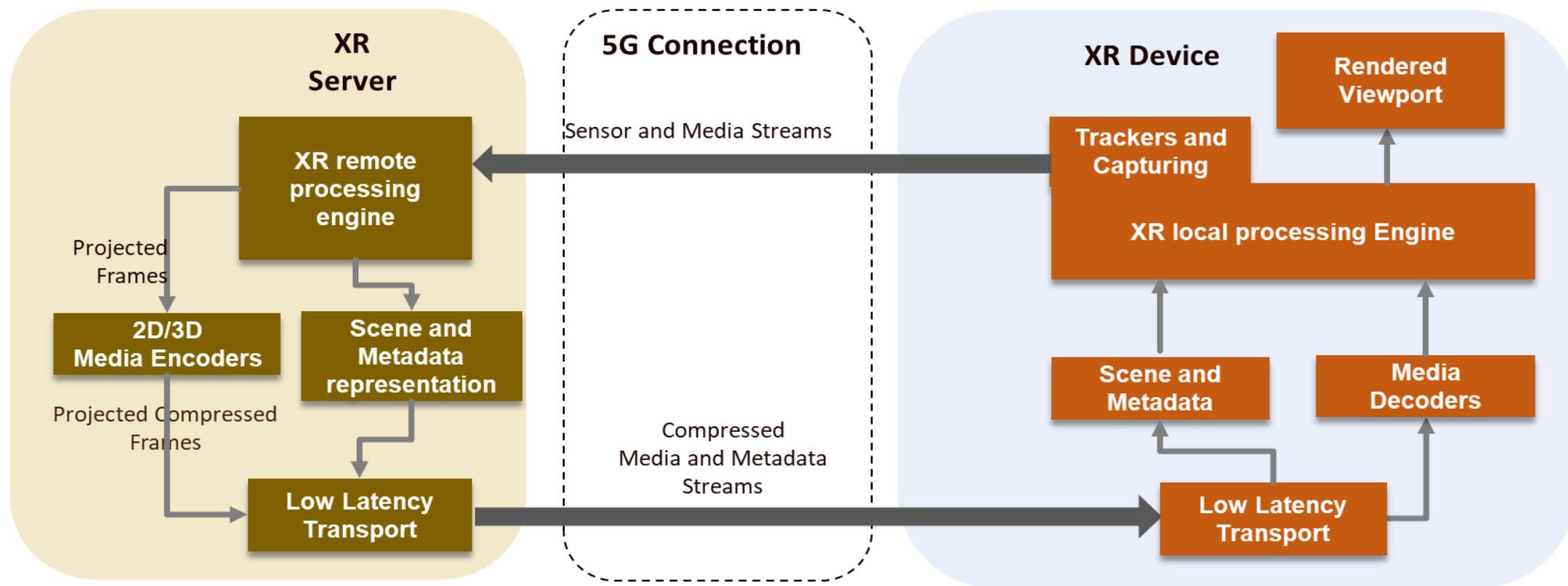
# Extended Reality over 5G

## Objectives

- Analysing the different **technologies** and **equipment** in place that provide an Extended Reality experiences.
- Collecting the associated **use cases** and identifying the 3GPP service(s) they map to
- Identifying
  - **media formats** (including audio and video), metadata, accessibility features...
  - **client** and **network architectures** and **APIs** that support XR use cases
  - **QoS service parameters** and other core network and radio functionalities that would be required or at least beneficial for XR use cases
- Possibly conducting **subjective tests** so as to estimate the audio and video formats and encoding parameters required for ensuring the quality of experience as considered necessary

# Extended Reality over 5G

## Reference architecture under consideration



# Extended Reality over 5G

## Some Use cases identified so far...

- 3D messaging
  - Ability to capture and send 3D models via MMS
- Streaming of Immersive 6DoF
  - Free navigation/ multiple viewpoints in video content
- Immersive online gaming and spectator mode
  - Free navigation in CGI content
- Remote assistance in Industry
  - AR guided assistance for onsite operations
- Realtime 3D communication
  - Immersive conferences including poster sharing
- Online shopping with AR
  - Augmented reality placement of products at home
- AR streaming with Localization registry
  - On-site virtual guides (museums...)

# Extended Reality over 5G

## Other topics on track

- **QoE Metrics for VR**
  - Objective: define device capability and latency metrics for the optimization of the quality of experience
  - Timeline: Release 16 (end of 2019)
- **Immersive Voice and Audio Services (IVAS)**
  - Objective: Immersive extension of the EVS (enhanced Voice Services) codec defined by 3GPP
  - Timeline: Release 17 (end of 2020)
- **Immersive Teleconferencing and Telepresence for Remote Terminals (ITT4RT)**
  - Objective: introduce immersive media support for 3GPP conversational services.
  - Timeline: Release 17 (end of 2020)
- **5G Media Streaming architecture (5GMSA)**
  - Objective: Modular architecture for streaming services including edge compute and slicing
  - Timeline: Release 16 (end of 2019)

# For more Information

Join us in our effort in defining standards for next generation  
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