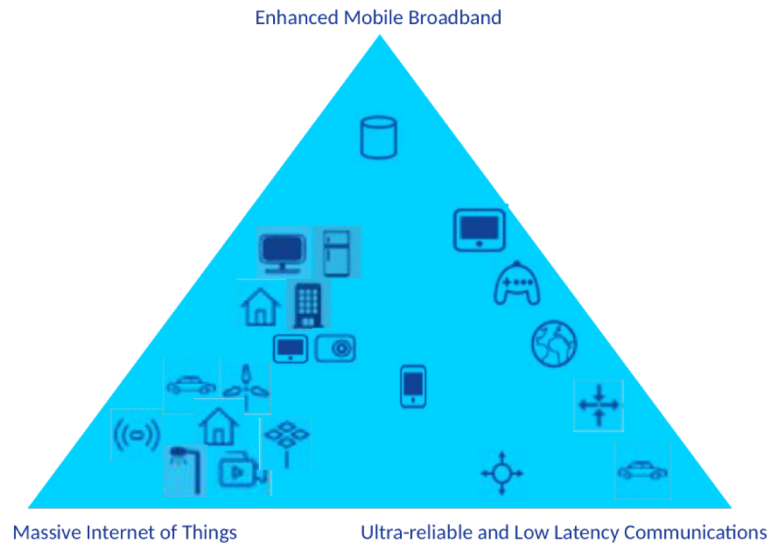










3GPP achievements on VR & ongoing developments on XR over 5G

Gilles Teniou
3GPP SA4 Vice-Chairman
Orange

5G VISION

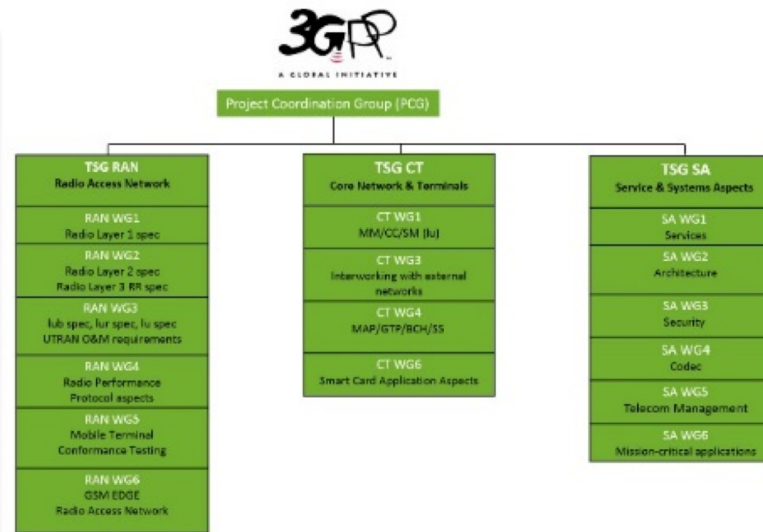
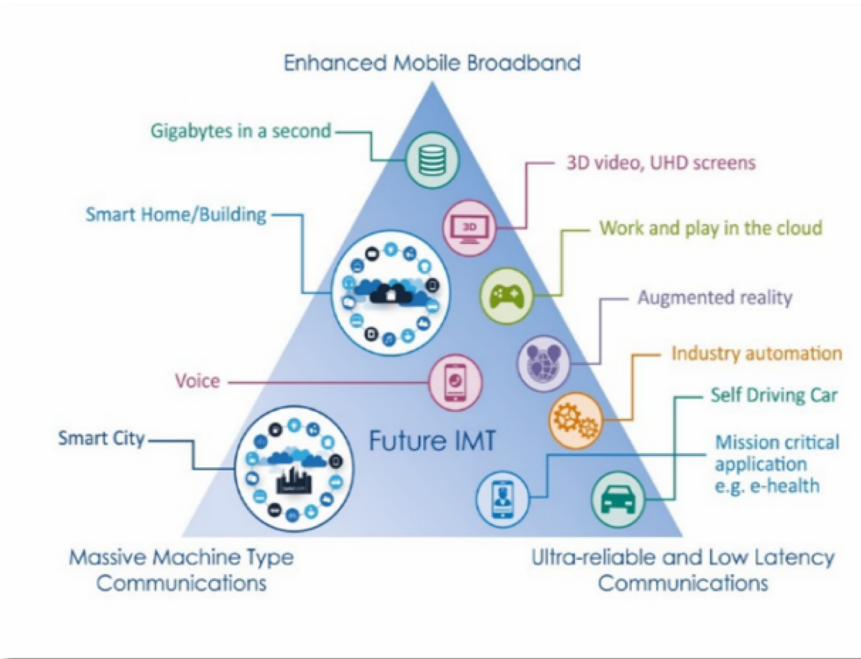


Broadband access in dense areas PERVERSIVE VIDEO 	Broadband access everywhere 50+ MBPS EVERYWHERE 	Higher user mobility HIGH SPEED TRAIN 	Massive Internet of Things SENSOR NETWORKS 
Extreme real-time communications TACTILE INTERNET 	Lifeline communications NATURAL DISASTER 	Ultra-reliable communications E-HEALTH SERVICES 	Broadcast-like services BROADCAST SERVICES 

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.

From the vision to standards



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
CODECS	26 series
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

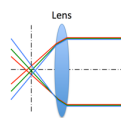
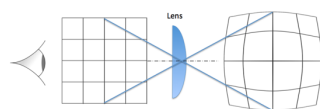
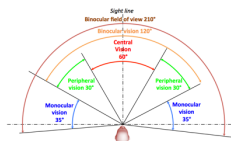
3GPP SA4 addresses the media distribution and codecs aspects such as audiovisuals and conversational services

Checkpoint on VR (360)

April 2016 – June 2017: Study on Virtual reality

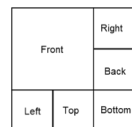
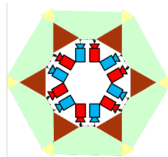
Video systems

- Human factors
- FOV and lenses
- Optical aberrations



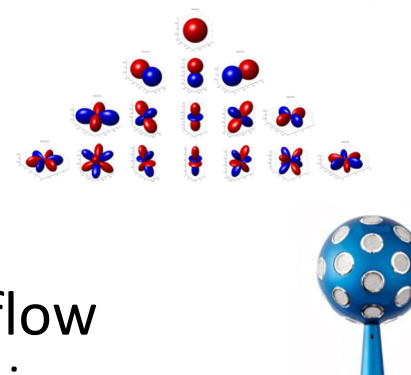
VR Video Workflow

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



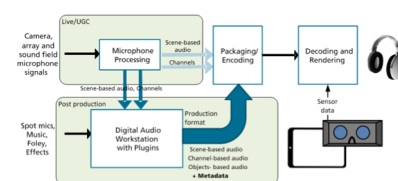
Audio systems

- 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

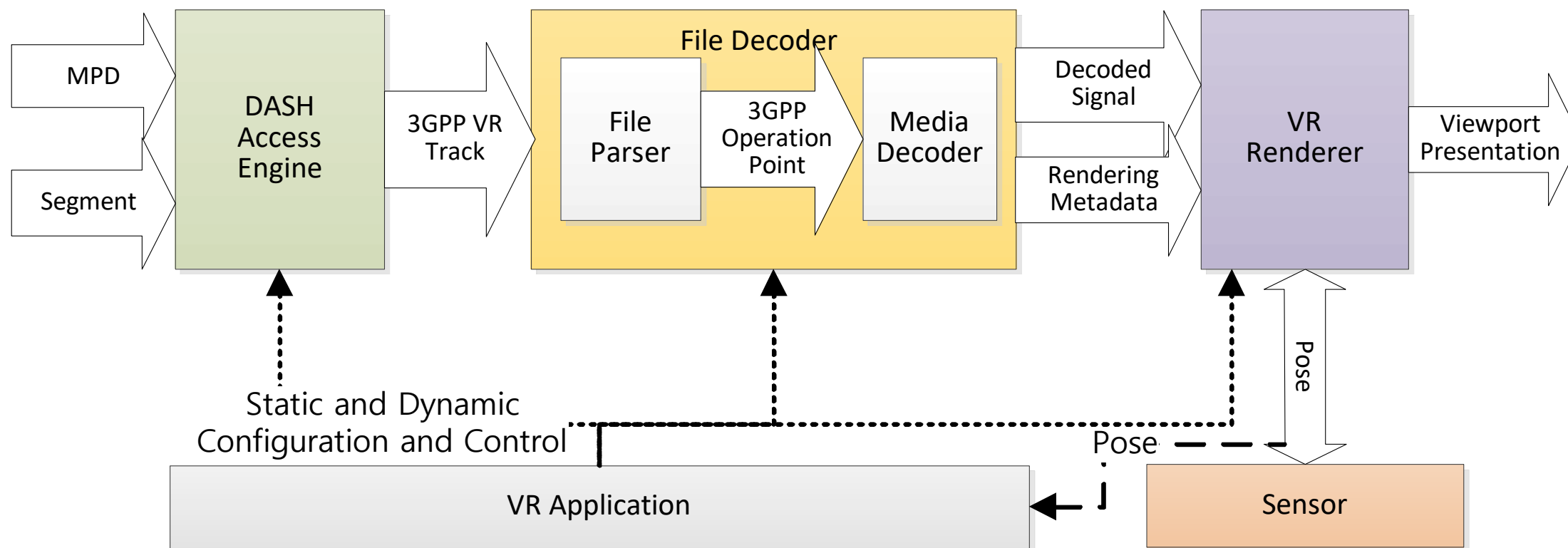


3GPP
TS 26.118

Virtual Reality
profiles for
streaming
applications

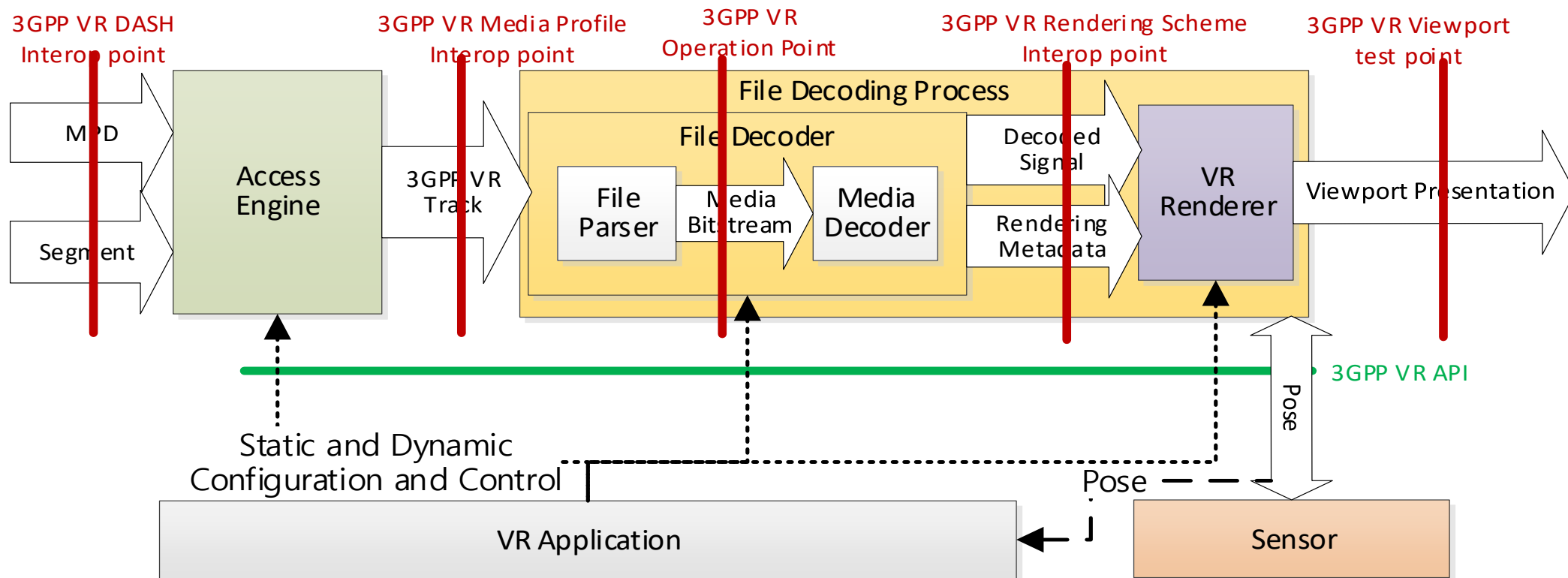
Checkpoint on VR (360) - TS 26.118

VR Streaming client architecture and API



Checkpoint on VR (360) - TS 26.118

VR Streaming client architecture and API



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

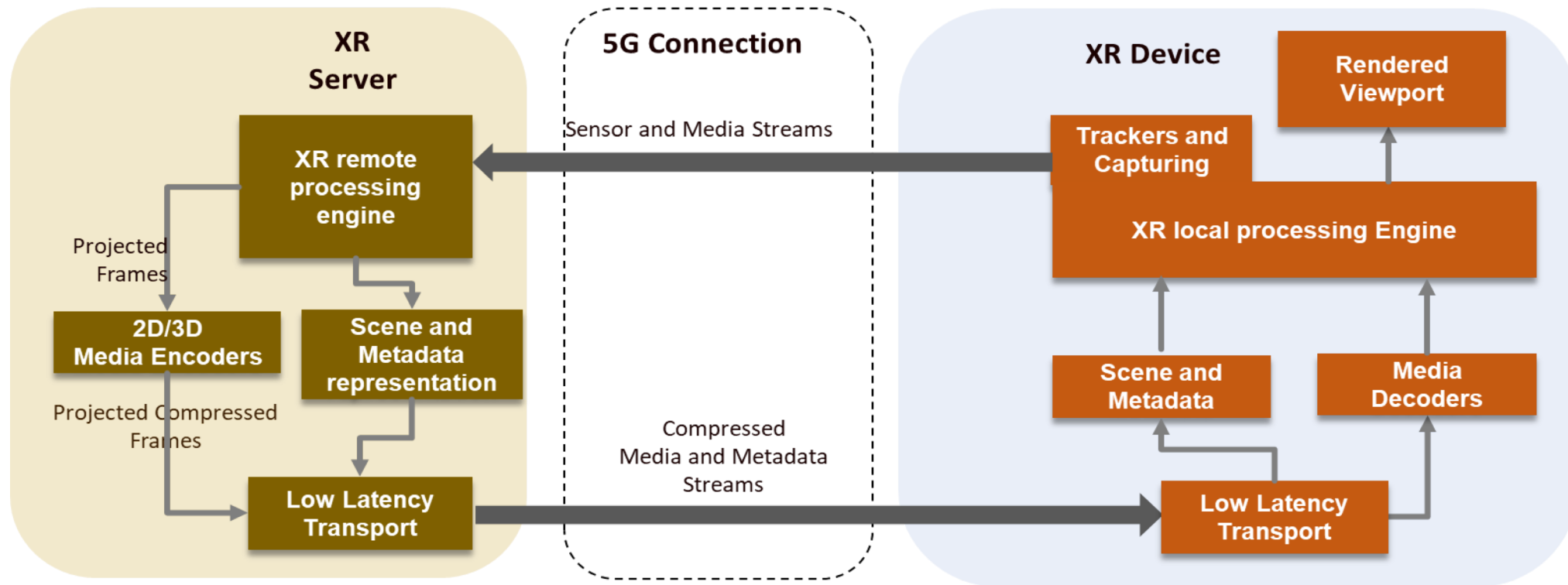


Objectives

- **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 or contact us:

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