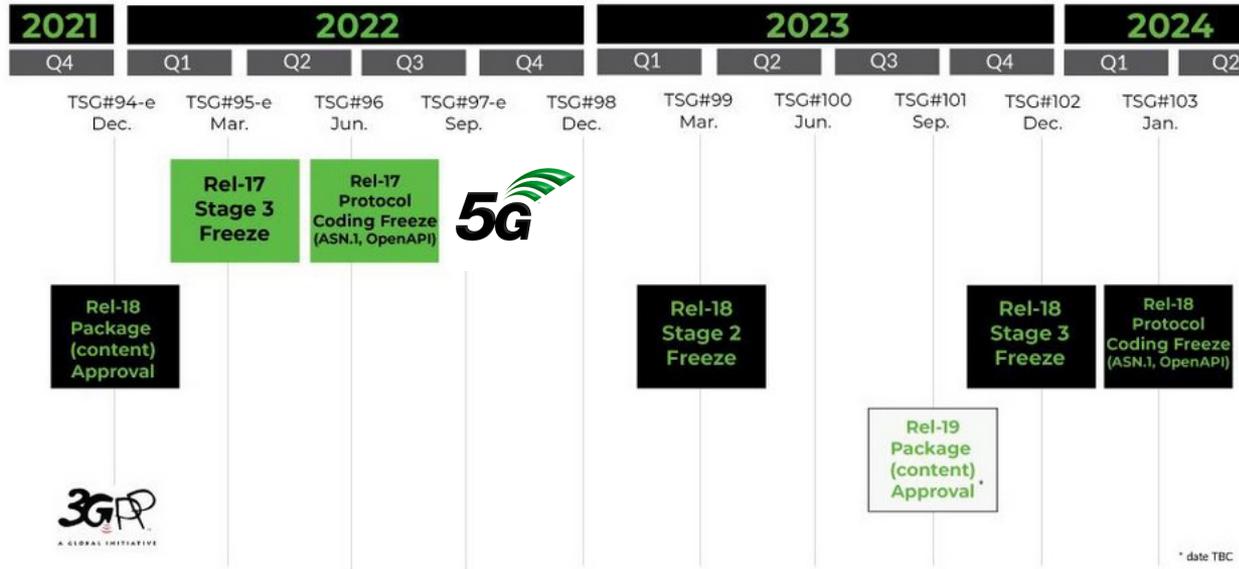


QoE (and XR) in 3GPP

3GPP Releases

Entering the era of 5G-Advanced

Release timelines:



6G will be standardized around release 21

3GPP TS 28.404 v17.3.0 (2022-09)

Quality of Experience (QoE) measurement collection; Concepts, use cases and requirements

- Concepts, business level use cases and requirements for the function Quality of Experience (QoE) measurement collection in 3GPP networks

Basically it defines the high-level business requirements (need to collect QoE measures, who initiates collection, etc.)

In R17, very brief (draft—like) document

Use cases / scenarios

- Collecting QoE information from a specific end user service type
- Collecting QoE information from end user service type of specific streaming sources
- Indication of QoE information collection
- Change collecting QoE information
- Collecting QoE information from end user service type from a specific user
- Temporary stop and restart of QoE information reporting during NR overload

3GPP TS 28.405 V18.0.0 (2022-09)

Quality of Experience (QoE) measurement collection; Control and configuration

Mechanisms used for the function Quality of Experience (QoE) measurement collection in 3GPP networks

DASH, MTSI, VR streaming (TS 26.118)

It defines the procedure to start / stop QMC (QoE Measurement Collection):

- For UTRAN, LTE and NR
- Management based and signalling based
 - (Two ways of apparently achieving the same)

Quality of Experience (QoE) measurement management parameters

- QoE collection entity address (M)
- QoE reference (M) -> network request session
- PLMN target (CM)
- Area Scope (CM) → list of cells / tracking area
- QMC configuration file (container) (M)
 - measConfigAppLayerContainer
- QMC Target (M) → area (0) or individual UE (1)
- Recording session id (M)
- Service type (M) → DASH (0), MTSI (1), VR (2)
- SliceScope (CM) → List of slices
- QoE Target (CM) → IMSI/SUPI of target UE

3GPP TS 28.406 V17.0.0 (2022-03)

Quality of Experience (QoE) measurement collection; Information definition and transport

Quality of Experience (QoE) information collection provides detailed information at session level on a number of UEs.

- Define the list of metrics to monitor in DASH and MTSI (IMS) environments

- Progressive Download and DASH (TS 26.247)
 - Representation Switch Events (DASH)
 - Average Throughput (PD, DASH)
 - Initial Playout Delay (PD, DASH)
 - Buffer Level (PD, DASH)
 - Play List (PD, DASH)
 - MPD Information (DASH)
 - Playout Delay for Media Start-up (?)
 - Device information (PD, DASH)
- MTSI (TS 26.114)
 - Corruption duration metric
 - Successive loss of RTP packets
 - Frame rate
 - Jitter duration
 - Sync loss duration
 - Round-trip time
 - Average codec bitrate
 - Codec information

3GPP TS 26.118 v17.0.0 (2022-05)

Virtual Reality (VR) profiles for streaming applications

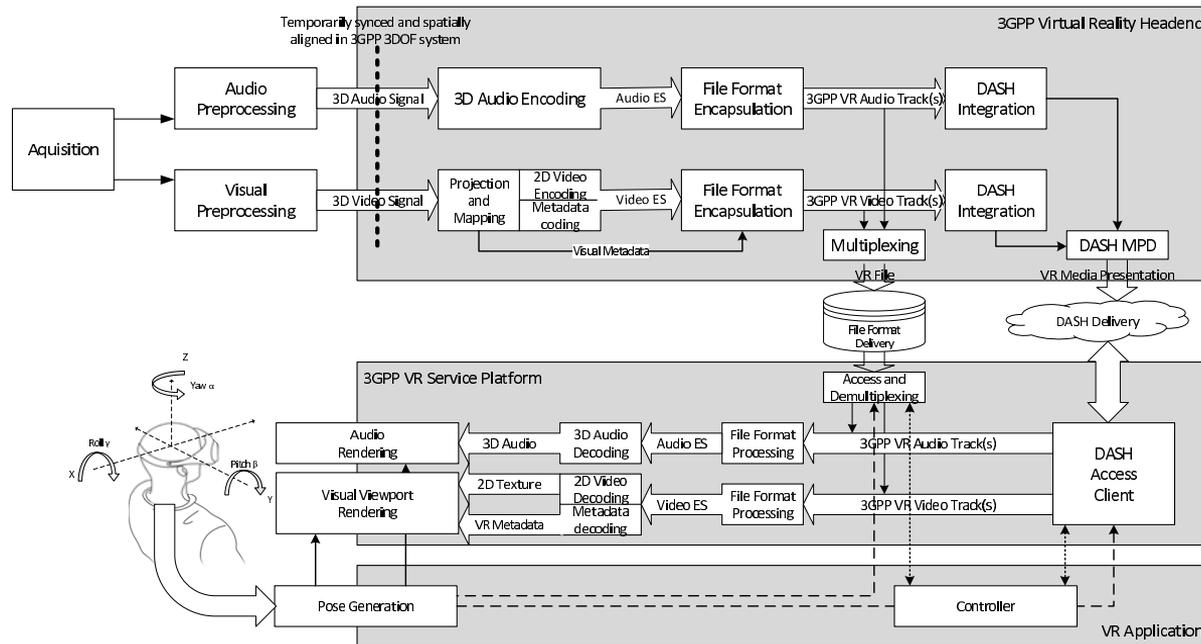


Figure 4.2-1: architecture for VR streaming services

VR streaming

It defines:

- Interfaces
- Video
- Audio
- Metadata
- VR Metrics

Very detailed spec

3GPP TS 26.118 v17.0.0 (2022-05)

Virtual Reality (VR) profiles for streaming applications → VR METRICS

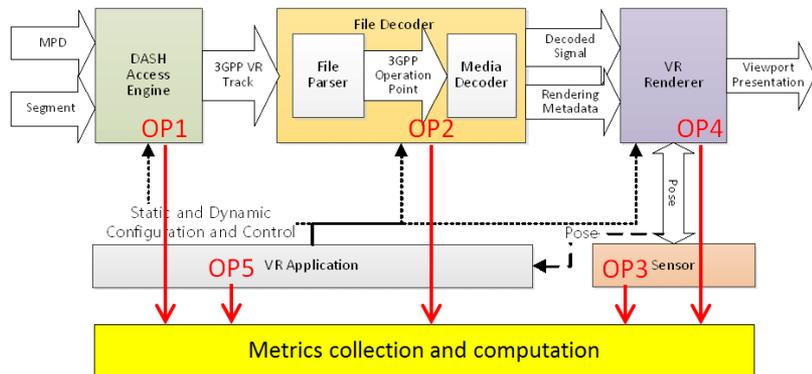


Figure 9.2.1-1: Client reference architecture for VR metrics

- OP1: MPD requests and content
- OP2: Resolution, codec, projection...
- OP3: Head pose, gaze direction
- OP4: Viewport, FR, latency, sync...
- OP5: Display res, FoV, IPD...

New metrics:

- Comparable quality viewport switching latency
- Rendered Viewports
- Spherical-Region Quality Rating (SRQR), defined in OMAF
- VR Device Information

Key	Type	Description
VrDeviceInformation	List	A list of device information objects.
Entry	Object	A single object containing new device information.
start	Real-Time	Wall-clock time when the device information was logged.
mstart	Media-Time	The presentation time at which the device information was logged.
deviceIdentifier	String	The brand, model and version of the device.
horizontalResolution	Integer	The horizontal display resolution, per eye, in pixels.
verticalResolution	Integer	The vertical display resolution, per eye, in pixels.
horizontalFoV	Integer	Maximum horizontal field-of-view, per eye, in degrees.
verticalFoV	Integer	Maximum vertical field-of-view, per eye, in degrees.
renderedHorizontalFoV	Integer	Current rendered horizontal field-of-view, per eye, in degrees.
renderedVerticalFoV	Integer	Current rendered vertical field-of-view, per eye, in degrees.
refreshRate	Integer	Display refresh rate, in Hz

3GPP TR 26.928 V17.0.0 (2022-04)

Extended Reality (XR) in 5G

- XR = real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables.
 - AR + MR + VR + interpolation
- Extension of human experiences especially relating to
 - the senses of existence (represented by VR)
 - the acquisition of cognition (represented by AR).
- Provide Immersion and Sense of Presence.
- Spatial computing
 - Parallax is the relative movement of objects as a result of a change in point of view.
 - Occlusion is the phenomena when one object in a 3D space is blocking another object from being viewed
- QoE analysis in progress → Release 18 (Technical Report)

3GPP TR 26.928 V17.0.0 (2022-04)

Extended Reality (XR) in 5G → Use Cases

No	Use Case	Type	Experience
1	3D Image Messaging	AR	3DoF+, 6DoF
2	AR Sharing	AR, MR	6DoF
3	Streaming of Immersive 6DoF	VR	3DoF+, 6DoF
4	Emotional Streaming	2D, AR and VR	2D, 3DoF+, 6DoF
5	Untethered Immersive Online Gaming	VR	6DoF
6	Immersive Game Spectator Mode	VR	6DoF
7	Real-time 3D Communication	3D, AR	3DoF+
8	AR guided assistant at remote location (industrial services)	2D video + dynamic AR	6DoF (2D + AR)
9	Police Critical Mission with AR	AR, VR	3DoF to 6DoF
10	Online shopping from a catalogue - downloading	AR	6DoF
11	Real-time communication with the shop assistant	AR	6DoF
12	360-degree conference meeting	AR, MR, VR	3DoF
13	3D shared experience	AR, MR, VR	3DoF+, 6DoF
14	6DOF VR conferencing	VR	6DoF
15	XR Meeting	AR, VR, XR	6DoF
16	Convention / Poster Session	AR, VR, MR	6DoF
17	AR animated avatar calls	AR	2D, 3DoF
18	Online shopping from a catalogue - downloading	AR	6DoF
19	Front-facing camera video multi-party calls	AR	3DoF
20	AR Streaming with Localization Registry	AR, Social AR	6DoF
21	Immersive 6DoF Streaming with Social Interaction	VR and Social VR	3DoF+, 6DoF
22	5G Online Gaming Party	VR	6DoF
23	Spatial Shared Data	AR	6DoF

3GPP TR 26.928 V17.0.0 (2022-04)

Extended Reality (XR) in 5G → Core Use Cases and Scenarios

Mapping to core use cases (“technical solutions”)

Core Use Cases and Scenarios	Clause	Use Case from Annex A
Offline Sharing of 3D Objects	5.2	Use Case 1: 3D Image Messaging Use Case 2: AR Sharing Use Case 10: Online shopping from a catalogue – downloading
Real-time XR Sharing	5.3	Use Case 7: Real-time 3D Communication Use Case 8: AR guided assistant at remote location (industrial services) Use Case 11: Real-time communication with the shop assistant Use Case 17: AR animated avatar calls Use Case 23: 5G Shared Spatial Data
XR Multimedia Streaming	5.4	Use Case 3: Streaming of Immersive 6DoF Use Case 4: Emotional Streaming Use Case 20: AR Streaming with Localization Registry Use Case 21: Immersive 6DoF Streaming with Social Interaction
Online XR Gaming	5.5	Use Case 5: Untethered Immersive Online Gaming Use Case 6: Immersive Game Spectator Mode Use Case 22: 5G Online Gaming party
XR Mission Critical	5.6	Use Case 9: Police Mission Critical with AR
XR Conference	5.7	Use Case 12: 360-degree conference meeting Use Case 13: 3D shared experience Use Case 14: 6DOF VR conferencing Use Case 15: XR Meeting Use Case 16: Convention / Poster Session
Spatial Audio Multiparty Call	5.8	Use Case 18: AR avatar multi-party calls Use Case 19: Front-facing camera video multi-party calls

3GPP TR 26.928 V17.0.0 (2022-04)

Extended Reality (XR) in 5G

Architecture	DL Rate range	UL Rate range	DL PDB	UL PDB	RTT	DL PER range	UL PER range	Traffic periodicity range	Traffic file size distribution
Viewport independent streaming	100 MBPs	HTTP requests every second. TCP handshake	See adaptive streaming	See adaptive streaming	See adaptive streaming and TCP equation	10e-6	10e-6	Almost constant	Almost constant
Viewport dependent streaming	25 MBPs	More frequent HTTP requests every 100ms. TCP handshake	See adaptive streaming	See adaptive streaming	See adaptive streaming and TCP equation	10e-6	10e-6	Almost constant	Almost constant
Viewport Rendering in Network case 1	100 MBit/s	FFS	FFS	FFS	FFS	FFS	FFS	FFS	FFS
Viewport Rendering in Network case 2	1 GBit/s	FFS	FFS	FFS	FFS	FFS	FFS	FFS	FFS
Viewport Rendering in Network case 3	10 Gbit/s	FFS	FFS	FFS	FFS	FFS	FFS	FFS	FFS
Raster-based Split Rendering with Pose Correction	100 Mbit/s	500 kbit/s	20ms	10ms	50ms	FFS	FFS	Almost constant	FFS
Generalized Split Rendering	FFS	FFS	FFS	FFS	FFS	FFS	FFS	FFS	FFS
XR Distributed Computing	FFS	FFS	FFS	FFS	FFS	FFS	FFS	FFS	FFS
XR Conversational	FFS	FFS	FFS	FFS	FFS	FFS	FFS	FFS	FFS
XR Conferencing	3Mbit/s up to 50Mbit/s per user	3Mbit/s up to 50Mbit/s	Allowing real time communication	Allowing real time communication	Allowing real time communication	FFS	FFS	almost constant (with peek during start-up)	> 50Mb at the beginning, depending on media consumption no or almost constant
Details are FFS									

3GPP TR 26.928 V17.0.0 (2022-04)

Extended Reality (XR) in 5G

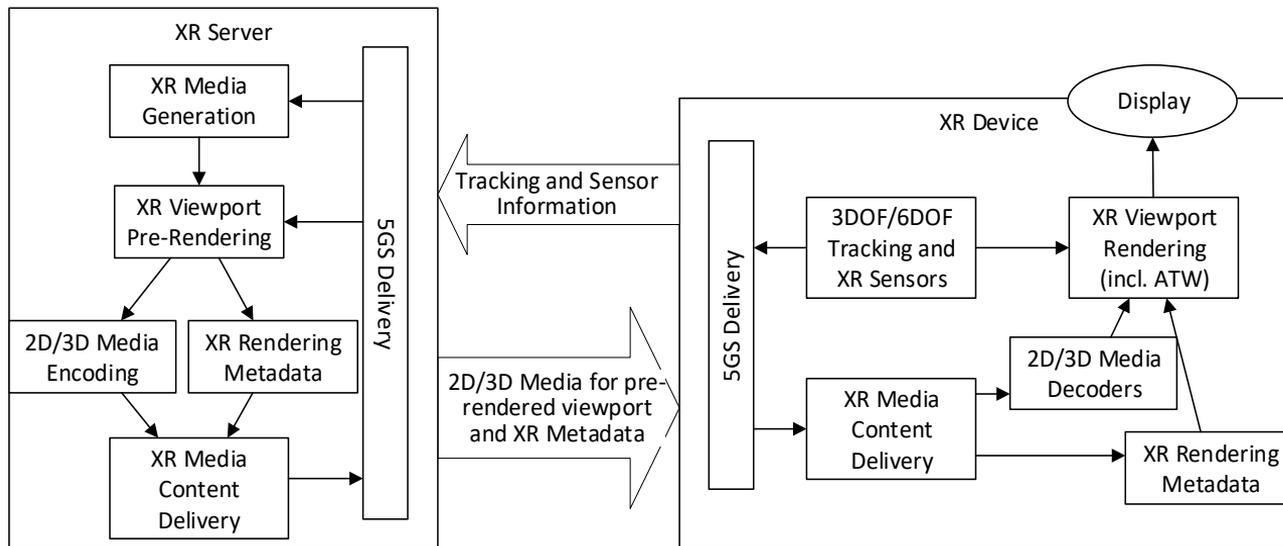


Figure 6.2.6-1: VR Split Rendering with XR Viewport Rendering in Device

3GPP TR 26.928 V17.0.0 (2022-04)

Extended Reality (XR) in 5G

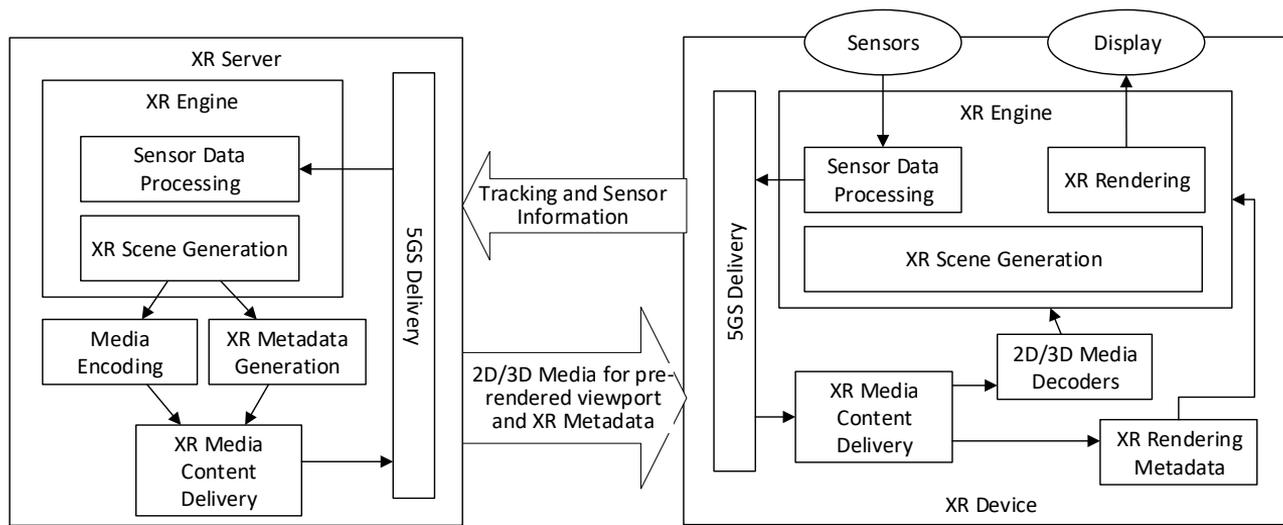


Figure 6.2.7-1: XR Distributed Computing Architecture

Extended Reality (XR) in 5G

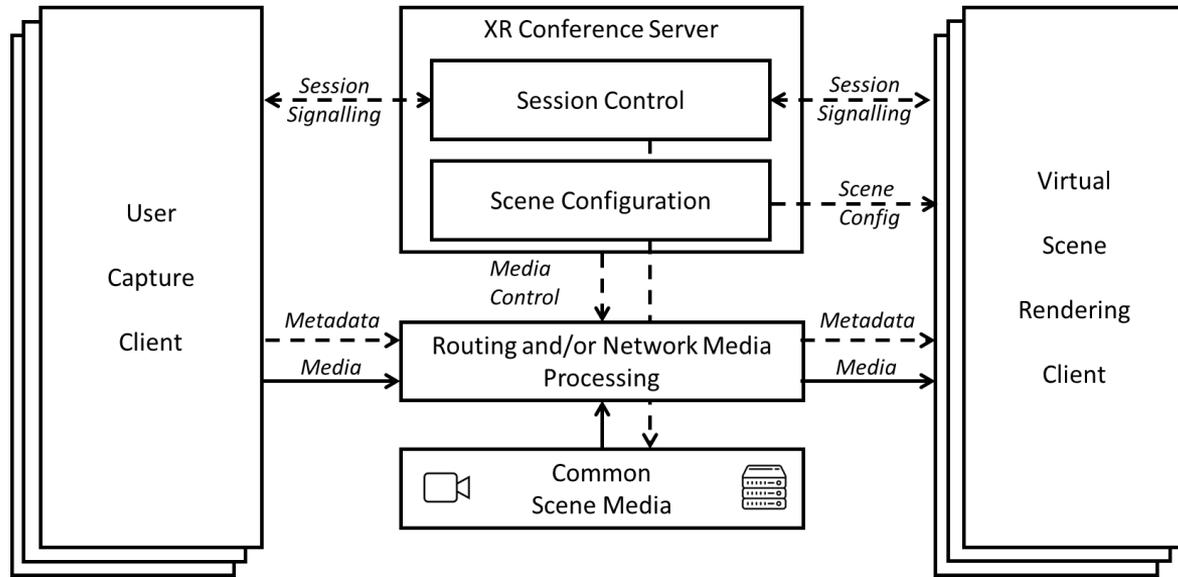


Figure 6.2.8-1 General architecture for XR conversational and conference services

NOKIA