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Information technology — Coded representation of immersive media —

Part 6: Immersive media metrics

AMENDMENT 1: Immersive media metrics for V3C Data and OMAF

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Normative references

Add the following reference:

ISO/IEC 23090-10, *Coded representation of immersive media — Part 10: Carriage of visual volumetric video-based coding data*

Terms and definitions

Replace the first sentence with: "For the purposes of this document, the terms and definitions given in ISO/IEC 23090-10 apply."

Clause 4

Add the following abbreviated terms:

3DoF	Three Degrees of Freedom
6DoF	Six Degrees of Freedom
V3C	Visual Volumetric Video-based Coding (ISO/IEC 23090-10)

6.1, first paragraph

Replace the third sentence with the following:

> A VR client may be an OMAF player or a V3C content player for file/segment reception or file access, file/segment decapsulation, decoding of audio, video, or image bitstreams, audio and image rendering, and viewport selection.

Figure 1

Update the figure to add missing text as follows:

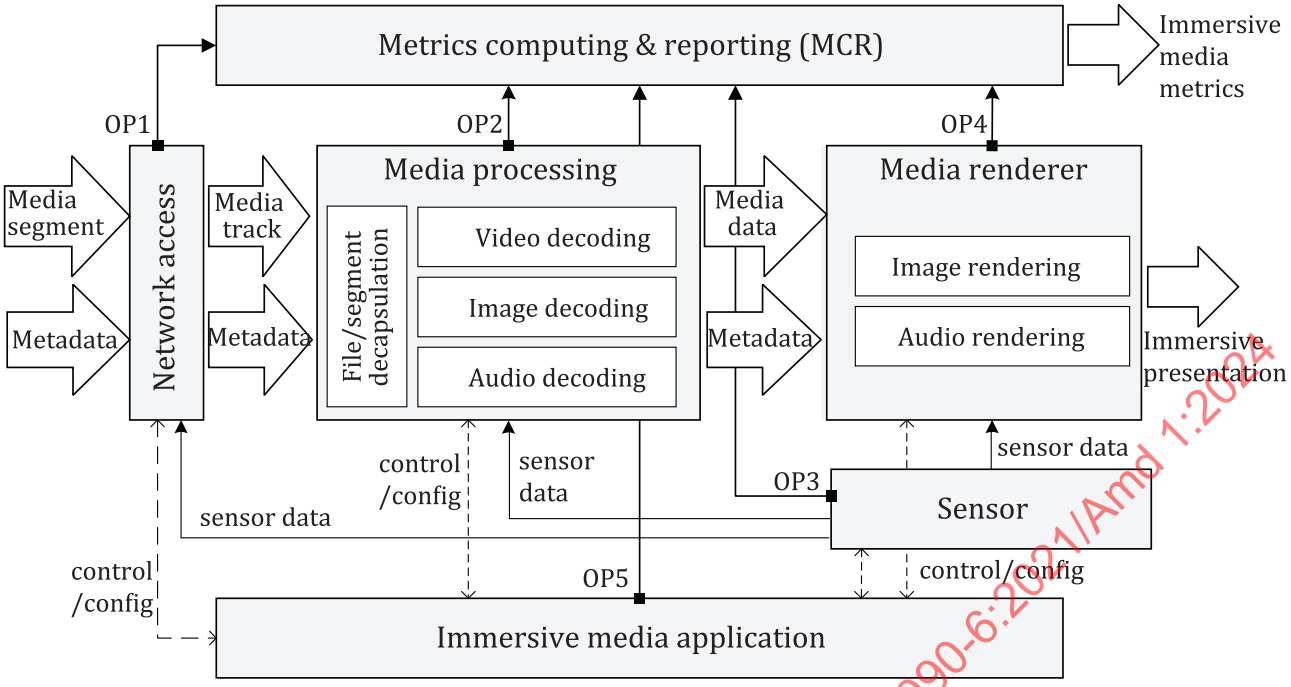

Figure 1 — Immersive media metrics client reference model

6.2.3

Add the following bullets before the last bullet:

— MIV metadata, for example:

  — viewport camera information;

  — viewport position information;

  — viewing space information

— V-PCC metadata, for example:

  — volumetric annotation information;

  — scene object information;

6.2.4

Add the following bullet at the end:

— Location information (i.e., x-y-z coordinates) corresponding to the current viewport

7.1

Delete Table 1 and replace the second paragraph with the following:

Two new data types are defined: `ViewportDataType` and `ViewpointDataType`. `ViewportDataType` is an object that defines a viewport and is defined as shown in Table 1, while `ViewpointDataType` is an object that defines a viewpoint and is defined as shown in Table 2.

Table 1 — ViewportDataType

Key	Type	Description
ViweportDataType	Object	
media_type	Integer	Specifies the type of the immersive media: 0 indicates omnidirectional media, 1 indicates V3C media, and other values are reserved.
viewport_omnidirectional	OmnidirectionViweportDataType	Specifies the viewport as an omnidirectional viewport. Shall only be present if the media_type is equal to 0.
viewport_v3c	V3CViewportDataType	Specifies the viewport as a V3C viewport. Shall only be present if the media_type is equal to 1.

Table 2 — ViewpointDataType

Key	Type	Description
ViewpointDataType	Object	
media_type	Integer	Specifies the type of the immersive media: 0 indicates omnidirectional, 1 indicates V3C, and other values are reserved.
viewpoint_omnidirectional	OmnidirectionViewpointDataType	Specifies the viewpoint as an omnidirectional viewpoint. Shall only be present if media_type is equal to 0.
viewpoint_v3c	V3CViewpointDataType	Specifies the viewpoint as a V3C viewpoint. Shall only be present if media_type is equal to 1.

For omnidirectional media, OmnidirectionalViewportDataType and OmnidirectionalViewpointDataType are defined as shown in Table 3 and Table 4, respectively.

Table 3 — OmnidirectionalViewportDataType

Key		Type	Description
OmnidirectionalViewportDataType		Object	
	viewpoint_id	Integer	Specifies the identifier of the viewpoint to which the viewport belongs. Each viewpoint has a unique viewpoint_id.
	centre_azimuth	Integer	Specifies the azimuth of the centre of the viewport in units of 2^{-16} degrees. The value shall be in the range of $-180 * 2^{16}$ to $180 * 2^{16} - 1$, inclusive.
	centre_elevation	Integer	Specifies the elevation of the centre of the viewport in units of 2^{-16} degrees. The value shall be in the range of $-90 * 2^{16}$ to $90 * 2^{16}$, inclusive.
	centre_tilt	Integer	Specifies the tilt angle of the viewport in units of 2^{-16} degrees. The value shall be in the range of $-180 * 2^{16}$ to $180 * 2^{16} - 1$, inclusive.
	azimuth_range	Integer	Specifies the azimuth range of the viewport through the centre point of the viewport, in units of 2^{-16} degrees.
	elevation_range	Integer	Specifies the elevation range of the viewport through the centre point of the viewport, in units of 2^{-16} degrees.

Table 4 — OmnidirectionalViewpointDataType

Key		Type	Description
OmnidirectionalViwepointDataType		Object	
	viewpoint_id	Integer	Specifies an identifier for the viewpoint. Each viewpoint has a unique viewpoint_id.
	centre_azimuth	Integer	Specifies the azimuth of the centre of the viewport in units of 2^{-16} degrees. The value shall be in the range of $-180 * 2^{16}$ to $180 * 2^{16} - 1$, inclusive.
	centre_elevation	Integer	Specifies the elevation of the centre of the viewport in units of 2^{-16} degrees. The value shall be in the range of $-90 * 2^{16}$ to $90 * 2^{16}$, inclusive.
	centre_tilt	Integer	Specifies the tilt angle of the viewport in units of 2^{-16} degrees. The value shall be in the range of $-180 * 2^{16}$ to $180 * 2^{16} - 1$, inclusive.

For V3C media, V3CViewportDataType and V3CViewpointDataType are defined as shown in Table 5 and Table 6, respectively.

Table 5 — V3CViewportDataType

Key		Type	Description
V3CViewportDataType		Object	
	viewpoint	V3CViewpointDataType	Specifies the viewpoint to which the viewport belongs. Note that each viewpoint has a unique viewpoint_id.
	camera_type	Integer	Specifies the projection method of the viewport camera. The value 0 specifies ERP projection. The value 1 specifies a perspective projection. The value 2 specifies an orthographic projection. Values in the range 3 to 255 are reserved for future use by ISO/IEC.
	erp_horizontal_fov	SignedInt	Specifies the longitude range for an ERP projection corresponding to the horizontal size of the viewport region, in units of radians. The value shall be in the range 0 to 2π. This is for camera_type = 0.
	erp_vertical_fov	SignedInt	Specifies the latitude range for an ERP projection corresponding to the vertical size of the viewport region, in units of radians. The value shall be in the range 0 to π. This is for camera_type = 0.
	perspective_horizontal_fov	SignedInt	Specifies the horizontal field of view for perspective projection in radians. The value of shall be in the range of 0 and π. This is for camera_type = 1.
	perspective_aspect_ratio	Float	Specifies the relative aspect ratio of viewport for perspective projection (horizontal/vertical). The value shall be expressed in 32-bit binary floating-point format with the 4 bytes in big-endian order and with the parsing process as specified in IEEE 754. This is for camera_type = 1.
	ortho_aspect_ratio	Float	Specifies the relative aspect ratio of viewport for orthogonal projection (horizontal/vertical). The value shall be expressed in 32-bit binary floating-point format with the 4 bytes in big-endian order and with the parsing process as specified in IEEE 754. This is for camera_type = 2.

Table 5 *(continued)*

Key		Type	Description
	ortho_horizontal_size	Float	Specifies the horizontal size of the orthogonal in metres. The value shall be expressed in 32-bit binary floating-point format with the 4 bytes in big-endian order and with the parsing process as specified in IEEE 754. This is for camera_type = 2.
	clipping_near_plane	Float	Specifies the near depth (or distance) based on the near clipping plane of the viewport in metres. The value shall be expressed in 32-bit binary floating-point format with the 4 bytes in big-endian order and with the parsing process as specified in IEEE 754.
	clipping_far_plane	Float	Specifies the far depth (or distance) based on the far clipping plane of the viewport in metres. The value shall be expressed in 32-bit binary floating-point format with the 4 bytes in big-endian order and with the parsing process as specified in IEEE 754.

Table 6 — V3CViewpointDataType

Key		Type	Description
V3CViewpointDataType		Object	
	viewpoint_id	String	Specifies the identifier of the viewpoint for V3C content.
	vp_pos_x	SignedInt	Indicates the x-coordinate of the position of the viewpoint in meters in the global reference coordinate system, as defined in ISO/IEC 23090-10:2022, subclause 10.2.1.2. The values shall be expressed in 32-bit binary floating point format with the 4 bytes in big-endian order and with the parsing process as specified in IEEE 754.
	vp_pos_y	SignedInt	Indicates the y-coordinate of the position of the viewpoint in meters in the global reference coordinate system, as defined in ISO/IEC 23090-10:2022, subclause 10.2.1.2. The values shall be expressed in 32-bit binary floating point format with the 4 bytes in big-endian order and with the parsing process as specified in IEEE 754.
	vp_pos_z	SignedInt	Indicates the z-coordinate of the position of the viewpoint in meters in the global reference coordinate system, as defined in ISO/IEC 23090-10:2022, subclause 10.2.1.2. The values shall be expressed in 32-bit binary floating point format with the 4 bytes in big-endian order and with the parsing process as specified in IEEE 754.

Table 6 *(continued)*

Key		Type	Description
	vp_quat_x	Integer	Indicates the x component of the rotation of the viewpoint region using the quaternion representation, as defined in ISO/IEC 23090-10:2022, subclause 10.2.1.2. The values shall be a floating-point value in the range of –1 to 1, inclusive.
	vp_quat_y	Integer	Indicates the y component of the rotation of the viewpoint region using the quaternion representation, as defined in ISO/IEC 23090-10:2022, subclause 10.2.1.2. The values shall be a floating-point value in the range of –1 to 1, inclusive.
	vp_quat_z	Integer	Indicates the z component of the rotation of the viewpoint region using the quaternion representation, as defined in ISO/IEC 23090-10:2022, subclause 10.2.1.2. The values shall be a floating-point value in the range of –1 to 1, inclusive.
	vp_center_view_flag	Booelan	As defined in ISO/IEC 23090-10:2022, subclause 10.2.3.2: Value equal to 1 indicates that the viewpoint position signalled corresponds to the center of the viewport. Value equal to 0 indicates that the viewpoint position signalled corresponds to one of two stereo positions of the viewpoint.
	vp_left_view_flag	Boolean	As defined in ISO/IEC 23090-10:2022, subclause 10.2.3.2: Value equal to 1 indicates that the viewpoint information signalled correspond to the left stereo position of the viewpoint. Value equal to 0 indicates that the viewpoint information signalled correspond to the right stereo positions of the viewport.
	viewport_type	Integer	Specifies the type of the viewport as listed in ISO/IEC 23090-10:2022, subclause 10.3.2.3, Table 11.

Renumber previous Tables 2 to 6 as Tables 7 to 11 respectively.

Clause 7

Add the following subclause at the end of the clause:

7.6 OMAF viewpoint switching latency

The viewpoint switching latency metric reports the latency experienced by the user when switching to a target viewport not being rendered until a viewport of the target viewpoint is rendered.

The viewpoint switching latency metric is specified in Table 12.

Table 12 — Viewpoint switching latency

Key	Type	Description
ViewpointSwitchingLatency	List	List of viewpoint switching latencies
Entry	Object	
originViewpoint	OmnidirectionalViewportDataType	Specifies the spherical region corresponding to a viewport of the origin viewpoint (i.e., before switching).
targetViewpoint	OmnidirectionalViewportDataType	Specifies the spherical region corresponding to a viewport of target viewpoint (i.e., after the switching).
t	Real-Time	Specifies the measurement time of the viewpoint switching latency in wall-clock time.
latency	Integer	Specifies the delay in milliseconds between the time when switching from a source viewpoint to the target viewpoint is initiated, as specified in subclause 8.4, and the time when content corresponding to the target viewpoint is reflected on the display.

Clause 8

Add the following subclause at the end of the clause:

8.4 OMAF viewpoint switching latency metric measurement

A potential viewpoint switch event is detected when a network request is made for a segment from a representation of a new viewpoint, whose representations are not currently being rendered, in response to an explicit user request or the user's interaction with the scene. In the case of sub-picture-based viewport-dependent streams, one or more segments corresponding to sub-pictures of the new viewpoint may be requested. The event is finally identified (i.e., completed) when a viewport from the new viewpoint (not currently being rendered) is eventually rendered after the requested segment(s) are downloaded and decoded.

When a potential viewpoint switch is detected, the client creates a record containing the detection time and the target viewpoint and adds this record to an in-memory data structure (e.g., a list) that keeps track of all pending viewpoint switching measurements. When rendering module renders a viewport with a new viewpoint ID that is different from the viewpoint ID of the preceding rendered viewport, the