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Information technology — Coded representation of immersive media —

Part 6: Immersive media metrics

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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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Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

A list of all parts in the ISO/IEC 23090 series can be found on the ISO website.

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Introduction

The immersive media metrics and measurement framework provide interoperability for consistent logging and monitoring of immersive media quality and experiences.

Annex A provides an illustration of immersive media metrics measurement.

Information technology — Coded representation of immersive media —

Part 6: Immersive media metrics

1 Scope

This document specifies immersive media metrics and the measurement framework. The immersive media metrics can be collected by service providers and used to enhance the immersive media quality and experiences. This document also includes a client reference model with observation and measurement points for collection of the metrics.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 23009-1:2019, *Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats*

ISO 23090-2, *Coded representation of immersive media — Part 2: Omnidirectional media format*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Abbreviated terms

2D	two-dimensional
2DQR	two-dimensional quality ranking
DASH	dynamic adaptive streaming over http
ER	effective resolution
ERT	effective resolution threshold
FOV	field of view
OMAF	omnidirectional media format
MCR	metrics computing and reporting

MPD	media presentation description
OP	observation point
PPI	pixels per inch
QR	quality ranking
QRT	quality ranking threshold
SRQR	spherical-region quality ranking
VR	virtual reality

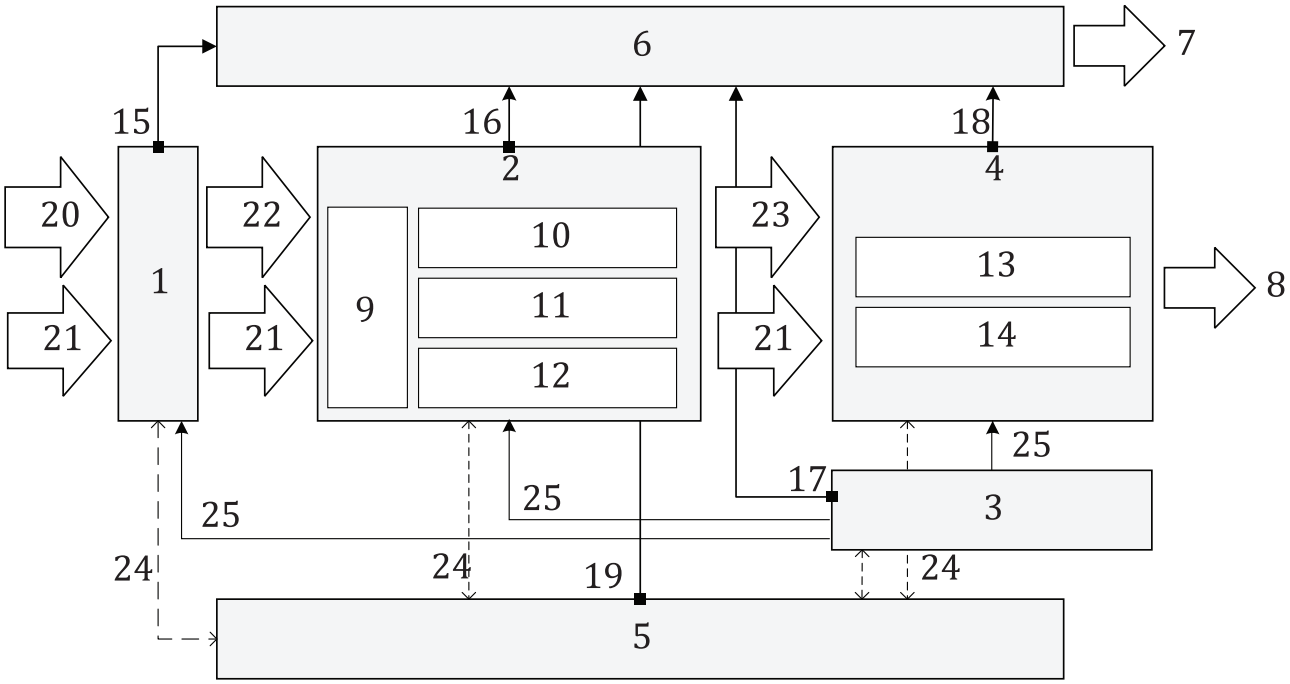
5 Arithmetic operators and mathematical functions

+	addition
–	subtraction (as a two-argument operator) or negation (as a unary prefix operator)
*	multiplication, including matrix multiplication
$\sum_{i=x}^{y} f(i)$	summation of $f(i)$ with i taking all integer values from x up to and including y

6 Immersive media metrics client reference model

6.1 Overview

A generic immersive media client reference model is shown in Figure 1 with observation points for metrics measurement. The model consists of key functional modules including network access, media processing, sensor, media renderer, and immersive media application. A VR client may be an OMAF 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. The metrics computing and reporting (MCR) module queries the measurable data from various functional modules and calculates the specified metrics. The MCR module may reside inside or outside of the VR client. The specified metrics may then be reported to an analytics server or other entities interested and authorized to access such metrics. The analytics server or other entities may use the metrics data to analyse the end user experience, assess client device capabilities, and evaluate the immersive system performance in order to enhance the overall immersive service experience across network, platform, device, applications and services.



Key

1	network access	14	audio rendering
2	media processing	15	OP1
3	sensor	16	OP2
4	media renderer	17	OP3
5	immersive media application	18	OP4
6	MCR	19	OP5
7	immersive media metrics	20	media segment
8	immersive presentation	21	metadata
9	file/segment decapsulation	22	media track
10	video decoding	23	media data
11	image decoding	24	control/config
12	audio decoding	25	sensor data
13	image rendering		

Figure 1 — Immersive media metrics client reference model

6.2 Definition of observation points

6.2.1 General

This clause defines the observation points as depicted in Figure 1.

6.2.2 Observation point 1

The network access module issues media file/segment requests and receives media files or segment streams from the network. The interface from the network access element towards MCR is referred to as observation point 1 (OP1). This observation point is equivalent to ISO/IEC 23009-1 observation point 1 as defined in ISO/IEC 23009-1:2019, D.3.2.

6.2.3 Observation point 2

The media processing module processes the file or the received media track, extracts the coded bitstreams, parses the media and metadata, and decodes the media. The interface from the media processing module towards MCR is referred to as observation point 2 (OP2).

The collectable data of OP2 includes parameters such as:

— MPD information, for example:

  — media type;

  — media codec;

  — adaptation set, representation, and preselection IDs;

— OMAF metadata, for example:

  — omnidirectional video projection;

  — omnidirectional video region-wise packing;

  — omnidirectional viewport;

— Other media metadata, for example:

  — frame packing;

  — colour space:

  — dynamic range.

6.2.4 Observation point 3

The sensor module acquires the user's viewing orientation, position and interaction. The interface from the sensor towards MCR is referred to as observation point 3 (OP3). The sensor data may be used by network access, media processing and media renderer module to retrieve, process and render VR media elements. For example, the current viewing orientation may be determined by the head tracking and possibly also eye tracking functionality. Besides being used by the renderer to render the appropriate part of decoded video and audio signals, the current viewing orientation may also be used by the network access for viewport dependent streaming and by the video and audio decoders for decoding optimization.

OP3 for example provides information of collectable sensor data for:

— the centre point of the current viewport;

— head motion tracking;

— eye tracking.

6.2.5 Observation point 4

The media renderer module synchronizes and playbacks the different VR media components to provide a fully immersive VR experience to the user. The decoded pictures are projected onto the screen of a head-mounted display or any other display device based on the current viewing orientation or viewport based on the metadata that includes information on region-wise packing, frame packing, projection, and sphere rotation as defined in ISO/IEC 23090-2. Likewise, decoded audio is rendered (e.g. through headphones) according to the current viewing orientation. The media renderer module may support colour conversion, projection, and media composition for each VR media component. The interface from the media renderer towards MCR is referred to as observation point 4 (OP4).

This observation point is equivalent to ISO/IEC 23009-1 observation point 3 as defined in ISO/IEC 23009-1:2019, D.3.4.

The collectable data from OP4 may, for example, include:

— the media type:

  — the media sample presentation timestamp:

  — wall clock time:

  — actual rendered viewport:

  — actual media sample rendering time:

  — actual rendering frame rate.

6.2.6 Observation point 5

The immersive media application manages the application configurations such as display resolution, frame rate, field of view (FOV), lens separation distance, etc. The interface from the immersive media application towards MCR is referred to as observation point 5 (OP5).

OP5 consists of client capability and configuration parameters, and the collectable data from OP5 includes, for example:

— display resolution;

— display density, in units of pixels per inch (PPI);

— horizontal and vertical FOV, in units of degrees;

— media format and codec support;

— OS support.

7 Metrics

7.1 General

This clause specifies specific immersive media metrics. The syntax for the DASH metrics as specified in ISO/IEC 23009-1:2019, D.4.1 is used for immersive media metrics with the following addition:

A new data type, `ViewportDataType`, is defined as shown in Table 1. `ViewportDataType` is an object with six integer keys that identify a viewport. The six keys are: `viewpoint_id`, `centre_azimuth`, `centre_elevation`, `centre_tilt`, `azimuth_range` and `elevation_range`.