Moving Picture, Audio and Data Coding
by Artificial Intelligence

MPAI Technical Specification

Object and Scene Description (MPAI-OSD)

V1.2

Technical Specification
Object and Scene Description (MPAI-OSD)
V1.2

Contents

1 Foreword

The international, unaffiliated, non-profit *Moving Picture, Audio, and Data Coding by Artificial Intelligence (MPAI)* organisation was established in September 2020 in the context of:

1. **Increasing** use of Artificial Intelligence (AI) technologies applied to a broad range of domains affecting millions of people
2. **Marginal** reliance on standards in the development of those AI applications
3. **Unprecedented** impact exerted by standards on the digital media industry affecting billions of people

believing that AI-based data coding standards will have a similar positive impact on the Information and Communication Technology industry.

The design principles of the MPAI organisation as established by the MPAI Statutes are the development of AI-based Data Coding standards in pursuit of the following policies:

1. Publish upfront clear Intellectual Property Rights licensing frameworks.
2. Adhere to a rigorous standard development process.
3. Be friendly to the AI context but, to the extent possible, remain agnostic to the technology thus allowing developers freedom in the selection of the more appropriate – AI or Data Processing – technologies for their needs.
4. Be attractive to different industries, end users, and regulators.
5. Address five standardisation areas:

1. *Data Type*, a particular type of Data, e.g., Audio, Visual, Object, Scenes, and Descriptors with as clear semantics as possible.
2. *Qualifier*, specialised Metadata conveying information on Sub-Types, Formats, and Attributes of a Data Type.
3. *AI Module* (AIM), processing elements with identified functions and input/output Data Types.
4. *AI Workflow* (AIW), MPAI-specified configurations of AIMs with identified functions and input/output Data Types.
5. *AI Framework* (AIF), an environment enabling dynamic configuration, initialisation, execution, and control of AIWs.
6. <u>Provide</u> appropriate Governance of the ecosystem created by MPAI Technical Specifications enabling users to:
    1. *Operate* Reference Software Implementations of MPAI Technical Specifications provided together with Reference Software Specifications
    2. *Test* the conformance of an implementation with a Technical Specification using the Conformance Testing Specification.
    3. *Assess* the performance of an implementation of a Technical Specification using the Performance Assessment Specification.
    4. *Obtain* conforming implementations possibly with a performance assessment report from a trusted source through the MPAI Store.
7.

Today, the MPAI organisation operated on four solid pillars:

1. The MPAI Patent Policy specifies the MPAI standard development process and the Framework Licence development guidelines.
2. *Technical Specification: Artificial Intelligence Framework (MPAI-AIF)* V2.1 specifies an environment enabling initialisation, dynamic configuration, and control of AIWs in the standard AI Framework environment depicted in Figure 1. An AI Framework can execute AI applications called AI Workflows (AIW) typically including interconnected AI Modules (AIM). MPAI-AIF supports small- and large-scale high-performance components and promotes solutions with improved explainability.

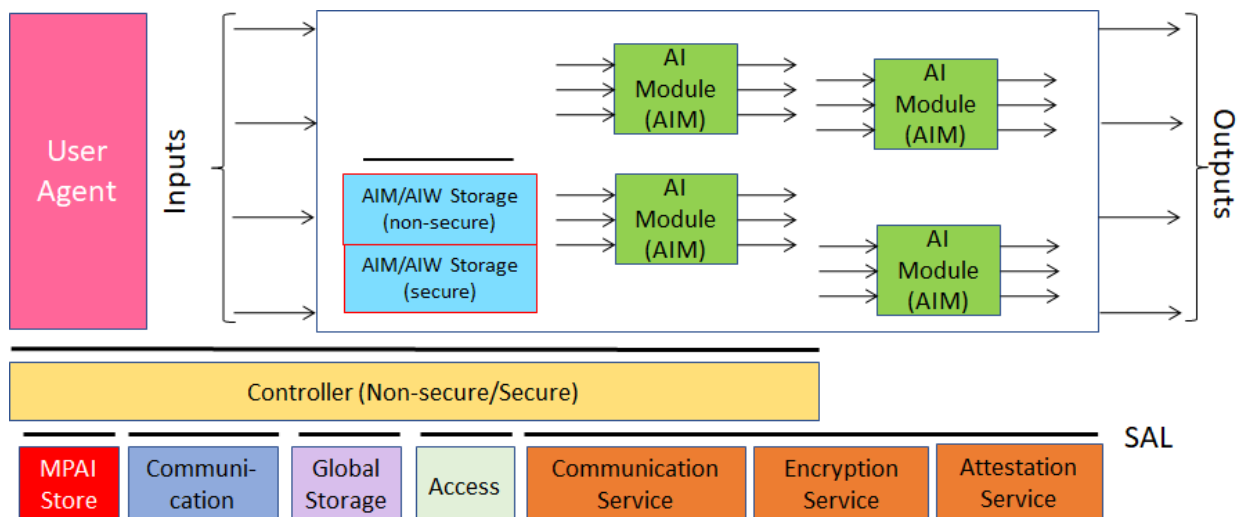*Figure 1 – The AI Framework (MPAI-AIF) V2 Reference Model*

3. *Technical Specification: Data Types, Formats, and Attributes (MPAI-TFA) V1.2* specifies Qualifiers, a type of metadata supporting the operation of AIMs receiving data from other AIMs. Qualifiers convey information on Sub-Types (e.g., the type of

colour), Formats (e.g., the type of compression and transport), and Attributes (e.g., semantic information in the Content). Although Qualifiers are human-readable, they are only intended to be used by AIMs. Therefore, Text, Speech, Audio, Visual, and other Data exchanged by AIWs and AIMs should be interpreted as being composed of Content (Text, Speech, Audio, and Visual as appropriate) and associated Qualifiers. Therefore a Text Object is composed of Text Data and Text Qualifier. The specification of most MPAI Data Types reflects this point.

4. *Technical Specification: Governance of the MPAI Ecosystem (MPAI-GME) V1.1* defines the following elements:
    1. Standards, i.e., the ensemble of Technical Specifications, Reference Software, Conformance Testing, and Performance Assessment.
    2. Developers of MPAI-specified AIMs and Integrators of MPAI-specified AIWS (Implementers).
    3. MPAI Store in charge of making AIMs and AIWs submitted by Implementers available to Integrators and End Users.
    4. Performance Assessors, independent entities assessing the performance of implementations in terms of Reliability, Replicability, Robustness, and Fairness.
    5. End Users.

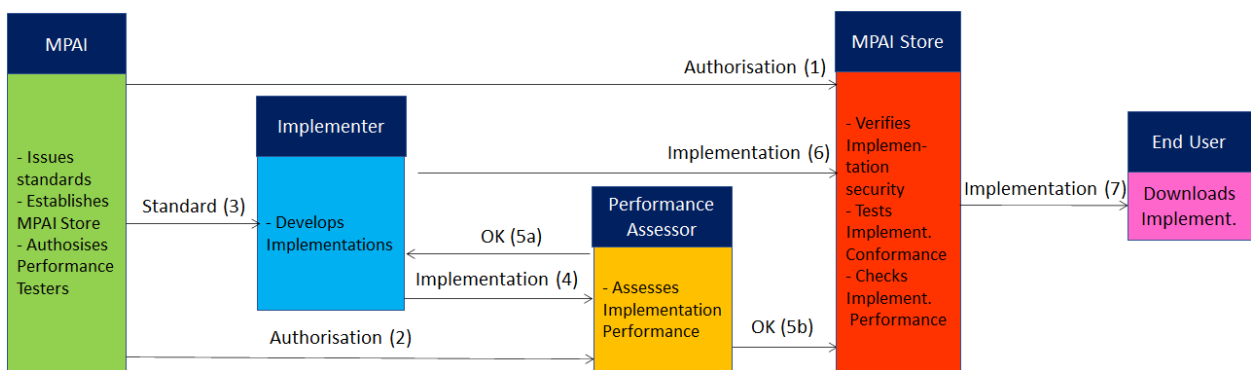The interaction between and among actors of the MPAI Ecosystem are depicted in Figure 2.

Figure 2 – The MPAI Ecosystem

2 Introduction (informative)

Several MPAI Technical Specifications need data types that refer to Objects and Scenes that are uni- and multimodal, refer to locations that may be in virtual spaces and include Space and Time information.

Technical Specification: Object and Scene Description (MPAI-OSD) V1.2 – in the following also called MPAI-OSD V1.2 or MPAI-OSD – has been developed to specify Time, Space, Object and Scene information for unified use across MPAI Technical Specifications and the specification to the Television Media Analysis (OSD-TMA) AI Workflow (AIW).

MPAI-OSD includes the complete OSD-TMA Reference Software Specification including the Open Source Software Implementation of the AIW and AIMs (released with BSD-3-vlause licence). The Reference Software Implementation offers users the opportunity to access Implementations that are Conforming with the Technical Specification. The AIMs used by OSD-TMA are sourced by the MPAI-CAE, MPAI-MMC, MPAI-OSD, and MPAI-PAF Technical Specifications.

In all Chapters and Sections, Terms beginning with a capital letter are defined in *Table 1* if they are specific to MPAI-OSD and in *Table 2* if they are common to all MPAI Technical Specifications. All Chapters, and Sections are Normative unless they are labelled as Informative.

3 Scope

Technical Specification: Object and Scenes Description (MPAI-OSD) V1.2 specifies:
1. Data Types and associated Qualifiers that are used to specify uni- and multi-modal Objects and Scenes in Virtual Environments with attributes of Space and Time.
2. The MPAI-OSD AI Modules and the Data Types .
3. The Television Media Analysis (OSD-TMA) AI Workflow using AI Modules and Data Types from MPAI-CAE, MPAI-MMC, and MPAI-PAF.

MPAI-OSD has been developed for uniform use across MPAI Technical Specifications with the cooperation of
1. The *AI Framework* (AIF-DC), *Context-based Audio Enhancement* (CAE-DC), *Multimodal Conversation* (MMC-DC), and *Portable Avatar Format* (PAF-DC).
2. The *Connected Autonomous Vehicle* (CAV) and *MPAI Metaverse Model* (MMM) groups of the Requirements Standing Committee.

In the future, MPAI may publish new Technical Specification in the MPAI-OSD scope that modify or extend the scope of this Technical Specification.

4 Definitions

Capitalised Terms have the meaning defined in *Table 1*. Terms applicable to all MPAI Technical Specifications are defined in *Table 2*. Non-capitalised terms have the meaning commonly defined for the context in which they are used or represent an entity in the real world. For instance, Table 1 defines *Object, Scene,* and *User* but does not define *object, scene,* and *human*. A dash "-" preceding a Term in Table 1 means the following:
1. If the font is normal, the Term in Table 1 without a dash and preceding the one with a dash should be placed <u>before</u> that Term. The notation is used to concentrate in one place all the Terms that are composed of, e.g., the word Data <u>followed</u> by one of the words Format and Type.
2. If the font is *italic,* the Term in the table without a dash and preceding the one with a dash should be placed <u>after</u> that Term. The notation is used to concentrate in one place all the Terms that are composed of, e.g., the word Descriptor <u>preceded</u> by one of the words Face and Body.

Table 1 – Terms and Definitions

Term	Definition
Attitude	
- *Spatial*	Position and Orientation and their velocities and accelerations of a Human and Visual Object in a Virtual Environment.
Audio	A Data Type an instance of which represents analogue signals – or is rendered to be perceived – in the human-audible range (16 Hz - 20 kHz).
Avatar	An Data Type including the 3D Model of an Avatar and the Face and Body Descriptors.

- Model	An inanimate Avatar exposing animation interfaces.
- *Portable*	A Data Type including Avatar ID, Time, Avatar, Language, Speech, Text, Speech Model, Personal Status, Audio-Visual Scene Descriptors, and potentially an input Portable Avatar.
Centre Point	The point of an Object selected to have coordinates (0,0,0).
Coordinate System	A system where the position of a point is specified by three numbers.
- *Cartesian*	A coordinate system where the three numbers are the signed distances from the point to three mutually perpendicular planes.
- *Spherical*	A coordinate system where the three numbers are: - the radial distance of that point from a fixed origin. - the polar angle measured from a fixed zenith direction. - the azimuthal angle of its orthogonal projection on a reference plane.
Data	Information in digital form.
- Format	A specific digital representation of Data.
- *Media*	Data representing Text, Speech, Audio, Visual, 3D Model, LiDAR, RADAR, Ultrasound information.
- Object	A Data Type including Data of a given Data Type and the Qualifier of that Data Type.
- Type	A recognised instance of Data.
Descriptor	The Digital Representation of a feature of an Object.
- *Audio-Visual*	A Data Type including the digital representation of the features of an audio-visual instance.
- *Body*	A Data Type including the digital representation of the features of the body of a real or digital human.
- *Face*	A Data Type including the digital representation of a feature of the face of a real or digital human.
- *Visual*	A Data Type including the digital representation of the features of a visual instance.
Digital Representation	Data corresponding to and representing a physical entity.
Environment	A Virtual Space that may be null or may include an Audio-Visual Scene.
Human	A human being in a real space.
- *Digital*	A Digitised or a Virtual Human.
- *Digitised*	An Object that has the appearance of a specific human when rendered.

- *Virtual*	An Object created by a computer that has a human appearance when rendered but is not a Digitised Human.
Identifier	The label uniquely associated with a human or an Object.
Instance	An element of a set of entities – Scenes, Digital Humans etc. – belonging to some levels in a hierarchical classification (taxonomy).
Object	A Data Type including Media Data and an optional Qualifier.
- *3D Model*	A Data Type including 3D Model Data and Qualifier.
- *Audio*	A Data Type including Audio Data and Qualifier.
- *Audio-Visual*	A Data Type including Audio-Visual Data and Qualifier.
- *Digital*	A Digitised or a Virtual Object.
- *Digitised*	Data representing a real object.
- *Speech*	A Data Type including Speech Data and Qualifier.
- *Text*	A Data Type including Text Data and Qualifier.
- *Visual*	A Data Type including Visual Data and Qualifier.
Orientation	The 3 Euler angles of an Object in a Virtual Space.
Position	The coordinates of a representative point for an object in a Virtual Space with respect to a set of coordinate axes.
Rendering	The process of instantiating Data or a Virtual Space as a human-perceptible entity.
Scene	A composition of Objects located according to a Scene Geometry.
- *3D Model*	A Scene composed of 3D Model Objects.
- *Audio*	A Scene composed of Audio Objects.
- *Audio-Visual*	A Scene composed of Speech and Audio Objects, Visual and 3D Model Objects, and co-located Audio-Visual Objects.
- *Speech*	A Scene composed of Speech Objects.
- *Visual*	A Scene composed of Visual Objects.
Scene Descriptors	A Data Type including the Media Objects and their spatial arrangement in a Scene.
- 3D Model	A Data Type including a Scene's 3D Model Objects and Sub-Scenes, and their spatial arrangement.
- *Audio*	A Data Type including an Audio Scene's Audio Objects and Sub-Scenes, and their spatial arrangement.

- *Audio-Visual*	A Data Type including an Audio Scene's Speech, Audio, Visual, 3D Model, and Audio-Visual Objects, and their spatial arrangement.
- *Visual*	A Data Type including a Visual Scene's Visual Objects and Sub-Scenes and their spatial arrangement.
Scene Geometry	A Data Type including the spatial arrangement of the Media Objects in a Scene.
3D Model	A Data Type describing the spatial arrangement of the 3D Model Objects and Sub-Scenes in a Scene.
- *Audio*	A Data Type describing the spatial arrangement of the Visual Objects and Sub-Scenes of a Scene.
- *Audio-Visual*	A Data Type describing the spatial arrangement of the Speech, Audio, Visual, 3D Model, and Audio-Visual Objects and Sub-Scenes of a Scene.
- *Speech*	A Data Type describing the Spatial arrangement of the Speech Objects and Sub-Scenes of a Scene.
- *Visual*	A Data Type describing the Spatial arrangement of the Visual Objects and Sub-Scenes of a Scene.
Selector	Input Data having the goal to set a parameter (e.g., use of Text vs Speech or Language Preference) or an operating mode of a Machine.
Speech	A Data Type an instance of which represents or is rendered to be perceived as human utterances.
Text	A series of characters drawn from a finite alphabet of a character set.
- *Recognised*	The Text at the output of an Automatic Speech Recognition AIM.
- *Refined Text*	The Text at the output of a Natural Language Understanding AIM.
Virtual Space	A space generated and maintained by a computing platform that can be rendered.

The Terms used in this standard whose first letter is capital and are not already included in *Table 1* are defined in *Table 2*. To concentrate in one place all the Terms that are composed of a common name followed by other words (e.g., the word Data <u>followed</u> by one of the words Format, Type, or Semantics), the definition given to a Terms preceded by a dash "-" applies to a Term composed by that Term without the dash preceded by the Term that precedes it in the column without a dash.

Table 2 – MPAI-wide Terms

Term	Definition
Access	Static or slowly changing data that are required by an application such as domain knowledge data, data models, etc.
AI Framework (AIF)	The environment where AIWs are executed.

AI Model (AIM)	A data processing element receiving AIM-specific Inputs and producing AIM-specific Outputs according to according to its Function. An AIM may be an aggregation of AIMs.
AI Workflow (AIW)	A structured aggregation of AIMs implementing a Use Case receiving AIW-specific inputs and producing AIW-specific outputs according to the AIW Function.
Application Standard	An MPAI Standard designed to enable a particular application domain.
Channel	A connection between an output port of an AIM and an input port of an AIM. The term "connection" is also used as synonymous.
Communication	The infrastructure that implements message passing between AIMs.
Component	One of the 7 AIF elements: Access, Communication, Controller, Internal Storage, Global Storage, Store, and User Agent
Composite AIM	An AIM aggregating more than one AIM.
Component	One of the 7 AIF elements: Access, Communication, Controller, Internal Storage, Global Storage, Store, and User Agent
Conformance	The attribute of an Implementation of being a correct technical Implementation of a Technical Specification.
– Testing	The normative document specifying the Means to Test the Conformance of an Implementation.
– Testing Means	Procedures, tools, data sets and/or data set characteristics to Test the Conformance of an Implementation.
Connection	A channel connecting an output port of an AIM and an input port of an AIM.
Controller	A Component that manages and controls the AIMs in the AIF, so that they execute in the correct order and at the time when they are needed
Data	Information in digital form.
– Format	The standard digital representation of Data.
– Type	An instance of Data with a specific Data Format.
– Semantics	The meaning of Data.
Descriptor	Coded representation of a text, audio, speech, or visual feature.
Digital Representation	Data corresponding to and representing a physical entity.
Ecosystem	The ensemble of actors making it possible for a User to execute an application composed of an AIF, one or more AIWs, each with one or more AIMs potentially sourced from independent implementers.
Explainability	The ability to trace the output of an Implementation back to the inputs that have produced it.
Fairness	The attribute of an Implementation whose extent of applicability can be assessed by making the training set and/or network open to testing for bias and unanticipated results.
Function	The operations effected by an AIW or an AIM on input data.
Global Storage	A Component to store data shared by AIMs.

AIM/AIW Storage	A Component to store data of the individual AIMs.
Identifier	A name that uniquely identifies an Implementation.
Implementation	1. An embodiment of the MPAI-AIF Technical Specification, or 2. An AIW or AIM of a particular Level (1-2-3) conforming with a Use Case of an MPAI Application Standard.
Implementer	A legal entity implementing MPAI Technical Specifications.
ImplementerID (IID)	A unique name assigned by the ImplementerID Registration Authority to an Implementer.
ImplementerID Registration Authority (IIDRA)	The entity appointed by MPAI to assign ImplementerID's to Implementers.
Instance ID	Instance of a class of Objects and the Group of Objects the Instance belongs to.
Interoperability	The ability to functionally replace an AIM with another AIW having the same Interoperability Level
– Level	The attribute of an AIW and its AIMs to be executable in an AIF Implementation and to: 1. Be proprietary (Level 1) 2. Pass the Conformance Testing (Level 2) of an Application Standard 3. Pass the Performance Testing (Level 3) of an Application Standard.
Knowledge Base	Structured and/or unstructured information made accessible to AIMs via MPAI-specified interfaces
Message	A sequence of Records transported by Communication through Channels.
Normativity	The set of attributes of a technology or a set of technologies specified by the applicable parts of an MPAI standard.
Performance	The attribute of an Implementation of being Reliable, Robust, Fair and Replicable.
– Assessment	The normative document specifying the Means to Assess the Grade of Performance of an Implementation.
– Assessment Means	Procedures, tools, data sets and/or data set characteristics to Assess the Performance of an Implementation.
– Assessor	An entity Assessing the Performance of an Implementation.
Profile	A particular subset of the technologies used in MPAI-AIF or an AIW of an Application Standard and, where applicable, the classes, other subsets, options and parameters relevant to that subset.
Record	A data structure with a specified structure
Reference Model	The AIMs and theirs Connections in an AIW.
Reference Software	A technically correct software implementation of a Technical Specification containing source code, or source and compiled code.
Reliability	The attribute of an Implementation that performs as specified by the Application Standard, profile, and version the Implementation refers to, e.g.,

	within the application scope, stated limitations, and for the period of time specified by the Implementer.
Replicability	The attribute of an Implementation whose Performance, as Assessed by a Performance Assessor, can be replicated, within an agreed level, by another Performance Assessor.
Robustness	The attribute of an Implementation that copes with data outside of the stated application scope with an estimated degree of confidence.
Scope	The domain of applicability of an MPAI Application Standard
Service Provider	An entrepreneur who offers an Implementation as a service (e.g., a recommendation service) to Users.
Standard	A set of Technical Specification, Reference Software, Conformance Testing, Performance Assessment, and Technical Report of an MPAI application Standard.
Technical Specification	(Framework) the normative specification of the AIF. (Application) the normative specification of the set of AIWs belonging to an application domain along with the AIMs required to Implement the AIWs that includes: 1. The formats of the Input/Output data of the AIWs implementing the AIWs. 2. The Connections of the AIMs of the AIW. 3. The formats of the Input/Output data of the AIMs belonging to the AIW.
Testing Laboratory	A laboratory accredited to Assess the Grade of Performance of Implementations.
Time Base	The protocol specifying how Components can access timing information
Topology	The set of AIM Connections of an AIW.
Use Case	A particular instance of the Application domain target of an Application Standard.
User	A user of an Implementation.
User Agent	The Component interfacing the user with an AIF through the Controller
Version	A revision or extension of a Standard or of one of its elements.
Zero Trust	A cybersecurity model primarily focused on data and service protection that assumes no implicit trust.

5   References

5.1   Normative Reference

1. MPAI; Technical Specification: AI Framework (MPAI-AIF) V2.1.
2. MPAI; Technical Specification: Context-based Audio Enhancement (MPAI-CAE) V2.2.
3. MPAI; Technical Specification: Multimodal Conversation (MPAI-MMC) V2.3.
4. MPAI; Technical Specification: Portable Avatar Format (MPAI-PAF) V1.3.
5. MPAI; Technical Specification: AI Module Profiles (MPAI-PRF) V1.0.
6. MPAI; Technical Specification: AData Types, Formats, and Attributes(MPAI-TFA) V1.2.

5.2 Informative References

7. MPAI; The MPAI Statutes; N421
8. MPAI; Patent Policy
9. MPAI; Technical Specification: Governance of the MPAI ecosystem (MPAI-GME) V1.1.
10. MPAI; Framework Licence: Object and Scene Description
11. MPAI; Technical Specification: Connected Autonomous Vehicles (MPAI-CAV) – Architecture (CAV-ARC) V1.1.
12. MPAI; Technical Specification: Connected Autonomous Vehicles (MPAI-CAV) – Technologies (CAV-TEC) V1.0.
13. MPAI; Technical Specification: MPAI Metaverse Model (MPAI-MMM) – Architecture (MMM-ARC) V1.2.
14. MPAI; Technical Specification: MPAI Metaverse Model (MPAI-MMM) – Technologies (MMM-TEC) V1.0.

6 AI Workflows

6.1 Technical Specifications

Technical Specification: Object and Scene Descriptors (MPAI-OSD) V1.2 assumes that implementations will be based on ***Technical Specification: AI Framework*** (MPAI-AIF) ***V2.1*** enabling dynamic configuration, initialisation, and control of AI Workflows (AIW) composed of interconnected AI Modules (AIM) in a standard AI Framework (AIF).

Table 1 displays the AIW specified by MPAI-OSD V1.1. Click the AIW to access its dedicated page, which includes a its functions, reference model, I/O Data, Functions of AIMs, I/O Data of AIMs, and a table providing links to the AIW-related AIW, AIMs, and JSON metadata.

Table 1 - AIWs of MPAI-OSD V2.0

	Name and Specification	JSON
OSD-TMA	Television Media Analysis	X

6.2 Reference Software

As a rule, MPAI provides Reference Software implementing the AI Modules released with the BSD-3-Clause licence and the following disclaimers:

1. The purpose of the Reference Software is to demonstrate a working Implementation of an AIW, not to provide a ready-to-use product.
2. MPAI disclaims the suitability of the Software for any other purposes than those of the MPAI-OSD Standard, and does not guarantee that it offers the best performance and that it is secure.
3. Users shall verify that they have the right to use any third-party software required by this Reference Software, e.g., by accepting the licences from third-party repositories.

6.3 Conformance Testing

An implementation of an AI Workflow conforms with MPAI-OSD if it accepts as input and produces as output Data and/or Data Objects (Data of a Data Type and its Qualifier) conforming with those specified by MPAI-HMC.

The Conformance of an instance of a Data is to be expressed by a sentence like "Data validates against the Data Type Schema". This means that:

- Any Data Sub-Type is as indicated in the Qualifier.

- The Data Format is indicated by the Qualifier.
- Any File and/or Stream have the Formats indicated by the Qualifier.
- Any Attribute of the Data is of the type or validates against the Schema specified in the Qualifier.

The method to Test the Conformance of a Data or Data Object instance is specified in the *Data Types* chapter.

6.4 Performance Assessment

Performance is a multidimensional entity because it can have various connotations. Therefore, the Performance Assessment Specification should provide methods to measure how well an AIW performs its function, using a metric that depends on the nature of the function, such as:

1. Quality: the Performance of a Television Media Analysis AIW can measure how well an AIM identifies the humans in a scene.
2. Bias: Performance of a Television Media Analysis AIW can measure the quality of face identification in dependence of the types of humans involved.
3. Legal compliance: the Performance of an AIW can measure the compliance of the AIW to a regulation, e.g., the European AI Act.
4. Ethical compliance: the Performance Assessment of an AIW can measure the compliance of an AIW to a target ethical standard.

The current MPAI-OSD V1.2 Standard does not provide AIW Performance Assessment methods.

7 AI Modules

7.1 Technical Specifications

Table 1 provides the links to the specifications and the JSON syntax of all AIMs specified by ***Technical Specification: Object and Scene Description (MPAI-OSD) V1.2***. All previously specified MPAI-OSD AI-Modules are superseded by those specified by V1.2 but may still be used by explicitly signaling their version. AI Modules in bold are Composite.

Table 1 - Specifications and JSON syntax of AIMs used by MPAI-OSD V1.2

AIMs	Name and Specification	JSON	AIMs	Name and Specification	JSON
OSD-AVA	Audio-Visual Alignment	X	OSD-VBD	Visual Basic Scene Description	X
OSD-ABS	**Audio-Visual Basic Scene Description**	**X**	OSD-VCD	Visual Change Detection	X
OSD-AVE	Audio-Visual Event Description	X	OSD-VDI	Visual Direction Identification	X
OSD-SDX	Audio-Visual Scene Demultiplexing	X	OSD-VII	Visual Instance Identification	X
OSD-AVS	**Audio-Visual Scene Description**	**X**	OSD-VOE	Visual Object Extraction	X
OSD-SMX	Audio-Visual Scene Multiplexing	X	**OSD-VOI**	**Visual Object Identification**	**X**
OSD-DVI	**Direct Visual Identification**	**X**	OSD-VSD	Visual Scene Description	X

OSD-TVS	Television Splitting	X			

7.2 Conformance Testing

An implementation of an AI Module Conforms with this Technical Specification if its input and output Data and/or Data Objects Conform with the Data or Data Objects specified in this Technical Specification. Note that **Data Object** is defined as the combination of Data of a certain Data Type and its Qualifier.

The Conformance of a Data instance is to be expressed by a sentence like "Data validates against the Data Type Schema". This means that:

- Any Data Sub-Type is as indicated in the Qualifier.
- The Data Format is indicated by the Qualifier.
- Any File and/or Stream have the Formats indicated by the Qualifier.
- Any Attribute of the Data is of the type or validates against the Schema specified in the Qualifier.

7.3 Reference Software

As a rule, MPAI provides Reference Software implementing the AI Modules released with the BSD-3-Clause licence and the following disclaimers:

1. The purpose of the Reference Software is to provide a working Implementation of an AIM, not a ready-to-use product.
2. MPAI disclaims the suitability of the Software for any other purposes than those of the MPAI-OSD Standard, and does not guarantee that it offers the best performance and that it is secure.
3. Users shall verify that they have the right to use any third-party software required by this Reference Software, e.g., by accepting the licences from third-party repositories.

Note that at this stage only part of the MPAI-OSD AIMs have a Reference Software Implementation.

7.4 Performance Assessment

Performance is a multidimensional entity because it can have various connotations. Therefore, the Performance Assessment Specification should provide methods to measure how well an AIW performs its function, using a metric that depends on the nature of the function, such as:

1. Quality: Performance Assessment measures how well an AIM performs its function, using a metric that depends on the nature of the function, e.g., how well a Visual Change Detection (VCD) AIM can detect the change of a visual scene.
2. Bias: Performance Assessment measures the preference given by an AIM to certain elements, using a metric that depends on a bias related to certain attributes of the AIM. For instance, a Visual Instance Identification (VII) AIM tends to have a higher correct identification of visual objects that have a certain shape.
3. Legal compliance: Performance Assessment measures how well an AIM performs its function, using a metric that assesses its accordance with a certain legal standard.
4. Ethical compliance: the Performance Assessment of an AIM can measure the compliance of an AIM to a target ethical standard.

The current MPAI-PAF V1.3 does not provide AIM Performance Assessment methods.

8 Data Types

8.1 Technical Specifications

This page gives the links to the specification of Data Types of *Technical Specification: Object Scene Description (MPAI-OSD) V1.2*. All previously specified MPAI-OSD Data Types that are specified by V1.2 are superseded. Use of earlier versions of Data Types is permitted if their version is explicitly signaled.

Table 1 provides the Data Types specified by MPAI-OSD V1.2. Additionally, MPAI-OSD AIWs and AIMs utilise Data Types specified by other MPAI Technical Specifications.

Table 1 - Data Types specified by MPAI-OSD V1.2

Annotation	Audio-Visual Basic Scene Descriptors	Audio-Visual Basic Scene Geometry	Audio-Visual Event Descriptors
Audio-Visual Object	Audio-Visual Scene Descriptors	Audio-Visual Scene Geometry	Basic Location
Bounding Box	Coordinates	Instance Identifier	Location
Orientation	Path	Perceptible Entity	Point of View
Position	Right Parallelepiped	Selector	Space-Time
Spatial Attitude	Time	Trajectory	Visual Basic Scene Descriptors
Visual Basic Scene Geometry	Visual Object	Visual Scene Descriptors	Visual Scene Geometry

8.2 Conformance testing

A Data instance of a Data Type Conforms with MPAI-OSD V1.2 if the JSON Data validate against the relevant MPAI-OSD V1.2 JSON Schema and if the Data Conforms with the relevant Data Qualifier, if present. MPAI-OSD V1.2 does not provide method for testing the Conformance of the Semantics of the Data instance to the MPAI-OSD V1.2 specification.

Conformance testing can be performed by a human using a JSON Validator to verify the Conformance of the syntax of JSON Data to the relevant JSON Schema; and, if the Data has a Qualifier, to verify that the syntax of the Data conforms with the relevant values in the Data Qualifier. Alternatively, Conformance testing can be performed by software implementing the steps above.

8.3 Performance Assessment

Performance Assessment provides methods of assessing the performance of an Data instance. Performance may have various connotations, such as:

1. *Quality*: Performance Assessment measures the quality of the Data instance using a metric that depends on the nature of the Data, e.g., the accuracy of identification of Visual Sources in a Visual Scene Geometry.
2. *Bias*: Performance Assessment measures the disparity of treatment applied to the Data instance using a metric that depends on a bias related to certain attributes of the Data instance. For example, a systematic misidentification of an object.

3. Legal compliance: Performance Assessment uses an appropriate metric to measure how well the Data instance complies with with a certain legal standard.

Table 1 provides the Data Types specified by MPAI-OSD V1.2. MPAI-OSD AIWs and AIMs also utilise Data Types specified by other MPAI Technical Specifications. The linked list of all MPAI Data Types is available.