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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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 23093 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO/IEC 23093 series provides an architecture and specifies APIs and compressed representation of data flowing between media things.

The APIs for the media things facilitate discovering other media things in the network, connecting and efficiently exchanging data between media things. The APIs also provide means for supporting transaction tokens in order to access valuable functionalities, resources, and data from media things.

Media things related information consists of characteristics and discovery data, setup information from a system designer, raw and processed sensed data, and actuation information. The ISO/IEC 23093 series specifies data formats of input and output for media sensors, media actuators, media storages, media analyzers, etc. Sensed data from media sensors can be processed by media analyzers to produce analysed data, and the media analyzers can be cascaded in order to extract semantic information.

This document contains the tools to describe data exchanged between media things (e.g. media sensors, media actuators, media analyzers, media storages) and their APIs. It addresses the normative aspects of the data and APIs for media things and also illustrates non-normative examples.

Information technology — Internet of media things —

Part 4:
Reference software and conformance

1 Scope

This document specifies the conformance and reference software implementing ISO/IEC 23093-3. The information provided is applicable for determining the reference software modules available for ISO/IEC 23093-3, understanding the functionality of the available reference software modules, and utilizing the available reference software modules.

Furthermore, this document provides means for conformance testing, i.e. bitstreams – XML descriptions – that conform or do not conform to ISO/IEC 23093-3.

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/IEC 23093-1, *Information technology — Internet of media things — Architecture*

ISO/IEC 23093-2, *Information technology — Internet of media things — Part 2: Discovery and communication API*

ISO/IEC 23093-3, *Information technology — Internet of media things — Part 3: Media data formats and APIs*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 23093-1, ISO/IEC 23093-2 and ISO/IEC 23093-3 apply.

3.2 Abbreviated terms

API application programming interface

MACV media actuator command vocabulary

MAOV media analyzer output vocabulary

MSOV media sensor output vocabulary

MTDL media thing description language

4 Reference software for ISO/IEC 23093-3

4.1 General

This clause specifies the reference software for ISO/IEC 23093-3. The software is available at: https://standards.iso.org/iso-iec/23093/-4/ed-1/en. The reference software is written in Java®[1)] and adopts the following package structure:

Name	*Definition*
`org`	Java package name for reference software provided by organizations such as ISO/IEC, W3C, or similar.
`org.iso`	Java package name for reference software provided by ISO/IEC.
`org.iso.mpeg`	Java package name for reference software.
`org.iso.mpeg.iomt`	Java package name for reference software provided in the course of the development of the ISO/IEC 23093 series. – `org.iso.mpeg.iomt.mtdl`, `org.iso.mpeg.iomt.msov`, `org.iso.mpeg.iomt.macv`, and `org.iso.mpeg.iomt.maov` for ISO/IEC 23093-3. NOTE Code included within these packages can be generated automatically by using tools such as JAXB (Java Architecture for XML Binding)[1].

4.2 ISO/IEC 23093-3 APIs for MTDL

4.2.1 General

This clause specifies the API to the ISO/IEC 23093-3 reference software. The API is defined in Java® and adopts the following package structures:

Name	*Definition*
`org.iso.mpeg.iomt.mtdl`	Java package name for API to the ISO/IEC 23093-3 reference software.

4.2.2 APIs for MThing

This clause specifies classes which are related to basic information of an `MThing`.

Name	*Definition*
`MThingInfo`	Java class which contains essential elements and attributes for an MThing.
`MSensorType`	Java class which is the super class that shall be extended by all of media sensors.
`MActuatorType`	Java class which is the super class that shall be extended by all of media actuators.
`MAnalyzerType`	Java class which is the super class that shall be extended by all of media analyzers.
`MStorageType`	Java class which is the super class that shall be extended by all of media storages.
`MManagerType`	Java class which is the super class that shall be extended by all of MThing managers.
`MAggregatorType`	Java class which is the super class that shall be extended by all of MThing aggregators.

1) Java® is the trademark of a product supplied by Oracle®. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

4.2.3 APIs for MSensor

This clause specifies classes which are related to an `MSensor`.

Name	*Definition*
`SensedDataBaseType`	Java class for describing a sensed data. All of the classes which are in the `org.iso.mpeg.iomt.msov` shall extend this class.
`SensorCapabilityListEnumType`	Java class for specifying the type of sensor capabilities among `allSensorCapabilityList`, `availableSensorCapabilityList`, and `appliedSensorCapabilityList`.
`SensorCapabilityListType`	Java class for describing a list of sensor capabilities.
`SensorCapabilityParameterType`	Java class for describing a parameter of a sensor capability.
`SensorCapabilityType`	Java class for describing a sensor capability.

4.2.4 APIs for MActuator

This clause specifies classes which are related to an `MActuator`.

Name	*Definition*
`ActuationDataBaseType`	Java class for describing an actuation data. All of the classes which are in the `org.iso.mpeg.iomt.macv` shall extend this class.
`ActuatorCapabilityListEnumType`	Java class for specifying the type of actuator capabilities among `allActuatorCapabilityList`, `availableActuatorCapabilityList`, and `appliedActuatorCapabilityList`.
`ActuatorCapabilityListType`	Java class for describing a list of actuator capabilities.
`ActuatorCapabilityParameterType`	Java class for describing a parameter of an actuator capability.
`ActuatorCapabilityType`	Java class for describing an actuator capability.

4.2.5 APIs for MAnalyzer

This clause specifies classes which are related to an `MAnalyzer`.

Name	*Definition*
`AnalyzedDataBaseType`	Java class for describing the analysed data. All of the classes which are in the `org.iso.mpeg.iomt.maov` shall extend this class.
`AnalyzerCapabilityListEnumType`	Java class for specifying the type of analyzer capabilities among `allAnalyzerCapabilityList`, `availableAnalyzerCapabilityList`, and `appliedAnalyzerCapabilityList`.
`AnalyzerCapabilityListType`	Java class for describing a list of analyzer capabilities.
`AnalyzerCapabilityParameterType`	Java class for describing a parameter of an analyzer capability.
`AnalyzerCapabilityType`	Java class for describing an analyzer capability.

4.2.6 APIs for MStorage

This clause specifies classes which are related to an `MStorage`.

Name	*Definition*
`StorageCommandBaseType`	Java class for describing a storage command.

Name	*Definition*
StorageCapabilityListEnumType	Java class for specifying the type of storage capabilities among allStorageCapabilityList, availableStorageCapabilityList, and appliedStorageCapabilityList.
StorageCapabilityListType	Java class for describing a list of storage capabilities.
StorageCapabilityParameterType	Java class for describing a parameter of a storage capability.
StorageCapabilityType	Java class for describing a storage capability.

4.2.7 APIs for MManager

This clause specifies classes which are related to an MManager.

Name	*Definition*
ManagerDataBaseType	Java class for describing a data for managing MThings.
ManagerCapabilityListEnumType	Java class for specifying the type of manager capabilities among allManagerCapabilityList, availableManagerCapabilityList, and appliedManagerCapabilityList.
ManagerCapabilityListType	Java class for describing a list of manager capabilities.
ManagerCapabilityParameterType	Java class for describing a parameter of a manager capability.
ManagerCapabilityType	Java class for describing a manager capability.

4.2.8 APIs for MAggregator

This clause specifies classes which are related to an MAggregator.

Name	*Definition*
AggregatedMThingListType	Java class for describing a list of aggregated MThings.
AggregatorCapabilityListEnumType	Java class for specifying the type of aggregator capabilities among allAggregatorCapabilityList, availableAggregatorCapabilityList, and appliedAggregatorCapabilityList.
AggregatorCapabilityListType	Java class for describing a list of aggregator capabilities.
AggregatorCapabilityParameterType	Java class for describing a parameter of an aggregator capability.
AggregatorCapabilityType	Java class for describing an aggregator capability.

4.3 ISO/IEC 23093-3 APIs for MSOV

— CapturedTimeType

4.4 ISO/IEC 23093-3 APIs for MACV

— AudioActuationType

— AudioPlayType

— SetBrightnessType

— SetCameraOrientationType

— SetCameraResolutionType

— SetCameraZoomType

— SetVolumeType

— VideoActuationType

— VideoPlayType

4.5 ISO/IEC 23093-3 APIs for MAOV

— BezierCurveType

— CommonMediaInfoType

— GroupBezierCurveType

— HandContourType

— HandGestureCommandType

— HandGestureType

— HandPostureType

— HandTrajectoryType

— HealthcareInfoType

— ImageInfoType

— PatientNameType

— PatientType

— SyncedVideoType

— VideoInfoType

5 Conformance for ISO/IEC 23093-3

5.1 General

This clause defines conformance for ISO/IEC 23093-3.

5.2 Schema-based conformance for ISO/IEC 23093-3

5.2.1 General

This subclause specifies the schema-based validation software for ISO/IEC 23093-3. The ISO/IEC 23093-3 validation software is written in Java® and adopts the following package structures:

Name	*Definition*
`validator`	Folder containing validator for schema-based validation.

For validating a MTDL description the following arguments should be used:

```
mtdl testmtdl.xml
```

For validating a MSOV description the following arguments should be used:

```
msov testmsov.xml
```

For validating a MACV description the following arguments should be used:

```
macv testmacv.xml
```

For validating a MAOV description the following arguments should be used:

```
maov testmaov.xml
```

5.2.2 Example of a valid MTDL instance test

```
mtdl testmtdl_valid.xml
```

The following output will be shown to indicate that the input XML instance is valid:

```
[Schema-based Validation check] mtdl is valid.
```

5.2.3 Example of an invalid MTDL instance test

```
mtdl testmtdl_invalid.xml
```

The following output will be shown to indicate that the input XML instance is invalid:

```
 [Schema-based Validation check] javax.xml.bind.UnmarshalException

  - with linked exception:

[org.xml.sax.SAXParseException; lineNumber: 5; columnNumber: 21; cvc-complex-type.2.4.a:
Inappropriate content starting with 'mtdl: MAnalyzer' element found. ": urn: mpeg: mpeg-
IoMT:" urn: mpeg: mpeg-IoMT: 2018: 01-MTDL-NS ": TimeStamp, "Urn: mpeg: mpeg-IoMT: 2018:
01-MTDL-NS" Manalyzer, "urn: mpeg: mpeg-IoMT: 2018: 01-MTDL-NS": MStorage, "urn: mpeg:
mpeg-IoMT: 2018: : 2018: 01-MTDL-NS ": MAggregator} '.]
```

The error in line 1 indicates that there can be missing elements of MThing.

5.2.4 Example of a valid MSOV instance test

```
msov testmsov_valid.xml
```

The following output will be shown to indicate that the input XML instance is valid:

```
[Schema-based Validation check] msov is valid.
```

5.2.5 Example of an invalid MSOV instance test

```
msov testmsov_invalid.xml
```

The following output will be shown to indicate that the input XML instance is invalid:

```
[Schema-based Validation check] javax.xml.bind.UnmarshalException

  - with linked exception:

[org.xml.sax.SAXParseException; lineNumber: 7; columnNumber: 67; The value of 'cvc-pattern-
valid:' 2018-09-07T10: 47 + 3309: 00 'has a value of' \ -? (\ d + (\ - \ d { 2?)?)?)?)?)?)
(F (2)} (? \ {2} \ d +)? ((\ - | \ +) \ d {2}: \ d {2})? ' This is not a good fit for the
pattern.]
```

The error in line 3 indicates that the value of SyncedTimeType is not fit to the specified pattern.

