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Part 5: IoMT autonomous collaboration

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Partie 5: Collaboration autonome dans l'IoMT

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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 23093 series can be found on the ISO and IEC websites.

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 and www.iec.ch/national-committees..

Introduction

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

The APIs for the MThings facilitate discovering other MThings in the network, connecting and efficiently exchanging data between MThings. The APIs also support transaction tokens to access valuable functionalities, resources, and data from MThings.

MThing-related information comprises characteristics and discovery data, mission descriptions from system designers and end-users, raw and processed sensed data and actuation information. The ISO/IEC 23093 series specifies input and output data formats for media sensors, actuators, storages, and analysers. In addition, media analysers can process sensed data from media sensors to produce analysed data, which can be cascaded to other media analysers to extract semantic information. Multiple MThings can be gathered and operated autonomously using mission descriptions given by system designers and end-users.

This document contains data formats and APIs to complete missions from system managers and end-users to operate multiple MThings autonomously. Refer to Figure 1 (items 1 and 1').

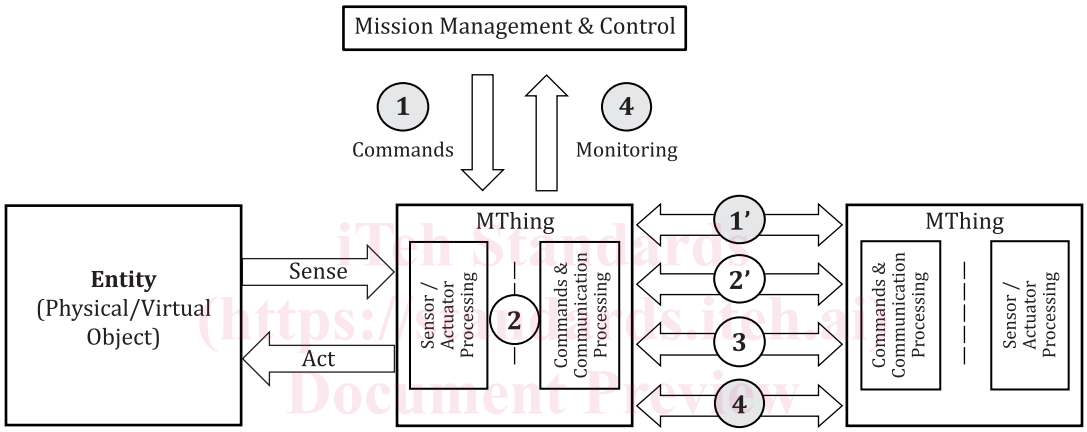

Figure 1 — Architectural view of the IoMT

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IoMT autonomous collaboration

1 Scope

This document specifies data formats and APIs for the mission management and control between MThings and end-users/system managers. Specifically, the following interfaces, protocols and associated media-related information representations are within the scope of this document:

— structured data formats (XML) representing the mission assigned by the user to the network of IoMT, for the data formats;

— structured data formats (XML) representing user commands to one or several MThings, possibly in a modified form (e.g. a subset of 1);

— APIs to exchange the data for mission management and control.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes the 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— Part 1: 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*

ISO/IEC 23093-6, *Information technology — Internet of media things — Part 6: Media data formats and APIs for distributed AI processing*

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, ISO/IEC 23093-3, ISO/IEC 23093-6 and the following apply.

ISO and IEC maintain terminology databases for use in standardisation at the following addresses:

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

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

3.1.1
media analyser
MAnalyser
MThing (3.1.5) that can analyse media or metadata and produce interpreted media, metadata, or commands

3.1.2
media manager
MManager
MThing (3.1.5) that can register a list of MThings or be facilitated to search other MThings

3.1.3
media sensor
MSensor
MThing (3.1.5) that can sense and produce media data

3.1.4
media storage
MStorage
MThing (3.1.5) that can save media or metadata

3.1.5
media thing
MThing
thing (3.2.20 in ISO/IEC 23093-1:2022) capable of sensing, acquiring, actuating, or processing of media or metadata

3.1.6
media thing controller
MThing controller
MController
MThing (3.1.5) that can generate standard mission descriptions, control and monitor the progress of the mission of the participating *MThings* (3.1.5)

3.1.7
mission
task that *MThings* (3.1.5) shall carry out

3.2 Abbreviated terms

MCOV media thing controller output vocabulary

4 Schema documents

4.1 General

In the main text of this document, the syntax and semantics of data interfacing MThings are provided whenever possible as a single schema document.

In some cases, though, particularly for Clause 7, the syntax of data interfacing MThings is provided as a collection of schema snippets imbricated with other text. To form a valid schema document, users can gather these schema components in the same document with the schema wrapper provided at the head of the clause. For better readability, the relevant schema documents are available at https://standards.iso.org/iso-iec/23093/-5/ed-1/en/.

In all cases, each schema document has a `version` attribute, "ISO/IEC 23093-5." Furthermore, an informative identifier is given as the value of the `id` attribute of the `schema` component. This identifier is non-normative and used as a convention in this document to reference another schema document. In particular, it is used for the `schemaLocation` attribute of the `include` and `import` schema components.

4.2 Use of prefixes

For clarity, throughout this document, consistent namespace prefixes are used.

"xsi:" prefix is not normative. It is a naming convention in this document to refer to an element of the https://www.w3.org/2001/XMLSchema-instance namespace.

"xml:" and "xmlns:" are normative prefixes defined in Reference [1]. The prefix "xml:" is bound to "https://www.w3.org/XML/1998/namespace." The prefix "xmlns:" is used only for namespace bindings and is not itself bound to any namespace name.

All other prefixes used in either the text or examples of this document are not normative, e.g. "mpeg7:", “mcov:”.

In particular, most informative examples in this document are provided as XML fragments without the typically required XML document declaration and, thus, miss a correct namespace binding context declaration. The different prefixes are bound to the namespaces in these description fragments, as given in Table 1.

Table 1 — Mapping of prefixes to namespaces in examples and text

Prefix	Corresponding namespace
mpeg7	urn:mpeg:mpeg7:schema:2004
mcov	urn:mpeg:mpeg-IoMT:2024:01-MCOV-NS
xsi	https://www.w3.org/2001/XMLSchema-instance
xsd	https://www.w3.org/2001/XMLSchema

5 An overview of the mission management and control-related issues

5.1 Mission data usage process

5.1.1 General

This subclause describes the processes and examples of how the mission data are generated, transmitted, modified, and utilized to accomplish automatic collaborations among MThings.

5.1.2 Mission data usage scenario

5.1.2.1 Mission composition and transmission

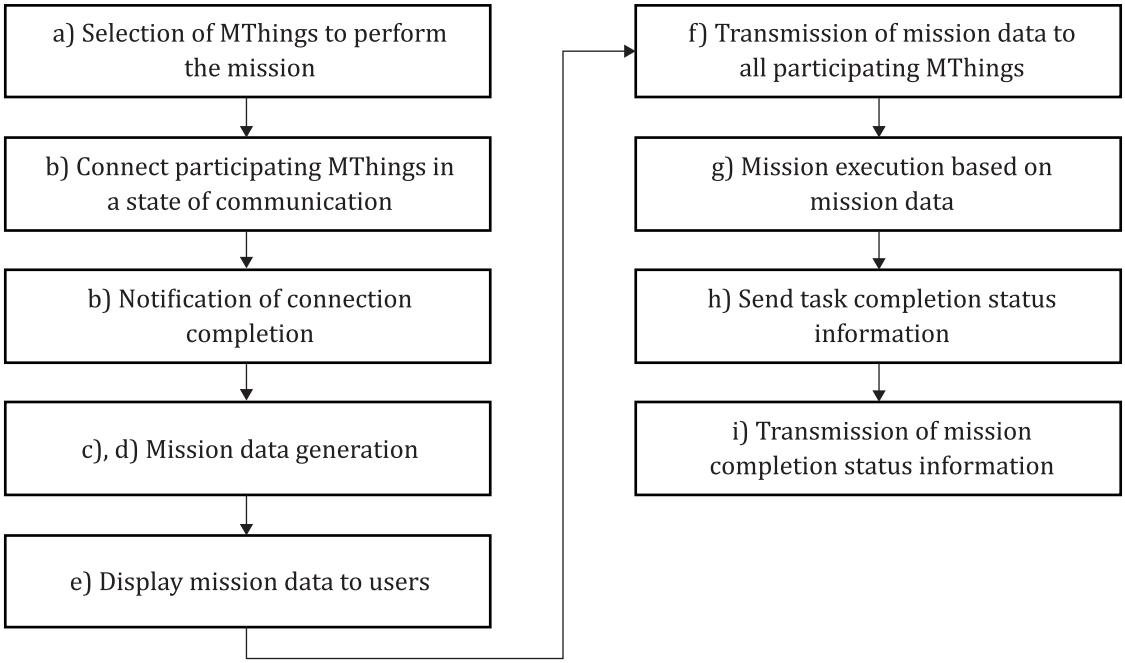

Figure 2 — Process of mission data composition and propagation

Figure 2 exemplifies how the mission data is generated, transmitted, and finalised. The process of composing and propagating the task descriptions of MThings could be as follows:

a) the user selects other MThings to complete the task desired by the user through their Graphic User Interface (GUI) applications,

b) after connection with MThings chosen by the user, the MThing notifies the user that the link has been established,

c) the user enters the role and execution order of each MThing. At this time, the user can describe or input the mission of each MThing through GUI, menu button interfaces, or natural language,

d) converts the user's input into the mission data using the corresponding standardised data format (e.g. XML),

e) the mission data (e.g. mission diagram) is presented to the user through the user's GUI to confirm it,

f) the mission data verified by the user is modified for each participating MThing and broadcast to all connected MThings,

g) the MThings start performing their respective tasks based on the transmitted mission data,

h) whenever each MThing completes its task recorded in the mission data, it broadcasts the completed status to other connected MThings (At this time, the user can check the task execution status of each MThing through their GUI),

i) and finally, when all tasks in the mission data are completed, the last MThing delivers status information notifying the completion of the mission to connected MThings. The user can check the notification about the mission completion through their GUI.

This process exemplifies one of the practical implementations to show the mission data creation and propagation, therefore, not restricted to it.

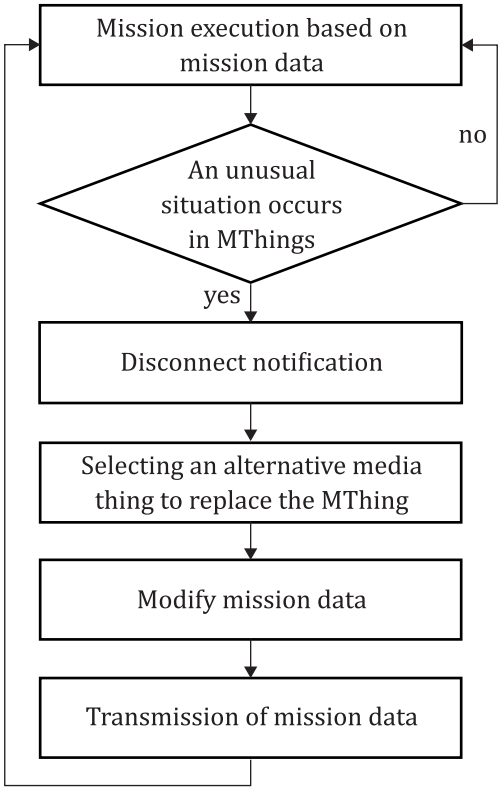

Figure 3 — Mission abort by an MThing

The following is an example of modifying the mission or stopping/excluding/modifying the related MThing due to a particular situation (e.g. malfunction or failure of an MThing) while performing the given mission.

— In case the connected MThing abandons a given task (e.g. `alertDisconnection()` defined in ISO/IEC 23093-2) (Figure 3)

  a) The MThing notifies all other connected MThings of its disconnection using the `alertDisconnection()` API defined in ISO/IEC 23093-2.

  b) The user checks this through the GUI and selects an MThing that can replace the disconnected MThing.

  c) The user modifies the task corresponding to the final state (replaced with a new MThing) using the state information, modifies and broadcasts the mission data, and performs steps D to I in Figure 2. At this time, MThings in the already completed state can release the connection or connected capability (e.g. using the `disconnectionMThing()` defined in ISO/IEC 23093-2). Mission data can also be modified accordingly.

In some cases, the above process can be replaced in a fully automated (more user-intervention) or autonomous (more AI-driven) manner.

— When the user arbitrarily aborts the mission by modifying the mission (Figure 4).

  a) When a user modifies a mission (e.g. adding a new MThing, adding a new function, or excluding an existing MThing), the currently executing mission can be forcibly aborted.

  b) The user modifies the mission data according to the purpose, broadcasts it to connected MThings, updates the mission, and performs steps C to I in Figure 2.