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Part 2: Discovery and communication API

*Technologies de l'information — Internet des objets media —
Partie 2: API pour la découverte et la communication*

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Foreword

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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*.

This second edition cancels and replaces the first edition (ISO/IEC 23093-2:2019), which has been technically revised. The main changes compared to the previous edition are as follows:

- Modification of introduction;
- Addition of new APIs for discovery and communication;
- Addition of a transaction model using state channels.

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 analysers, etc. Sensed data from media sensors can be processed by media analysers to produce analysed data, and the media analysers can be cascaded in order to extract semantic information.

This document contains the APIs to discover media things in the network, and communicate between media things along with the APIs to facilitate transactions between media things.

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Information technology — Internet of media things — Part 2: Discovery and communication API

1 Scope

This document specifies the abstract class of a media thing (MThing), which is a basic component to construct Internet of media things. The MThing class contains the basic APIs to:

- discover other MThing(s) in the network;
- connect/disconnect MThing(s);
- support transactions (e.g. payments) using media tokens between MThings.

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 23093-1¹, *Information technology — Internet of media things — Part 1: Architecture*

ISO/IEC 23093-3:—², *Information technology — Internet of media things — Part 3: Media data formats and API*

<https://standards.iteh.ai/catalog/standards/sist/dac42b05-ab05-414b-a224-c9af86ac3285/iso-iec-dis-23093-2>

ISO/IEC 21000-7:2007, *Information technology — Multimedia framework (MPEG-21) — Part 7: Digital Item Adaptation*

3 Terms and definitions

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

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 <http://www.electropedia.org/>

4 APIs

4.1 General

This clause specifies APIs to discover MThings, and connect/disconnect communication between MThings. In addition, APIs and return class types are specified to provide MThing information and hardware descriptions.

¹ Under preparation. Stage at time of publication: ISO/IEC DIS 23093-1:2019.

² Under preparation. Stage at time of publication: ISO/IEC FDIS 23093-3:2019.

An MThing can be discovered by its capabilities and/or supported media token types. The discovered MThing(s) can then relay its (their) information to the requester (i.e. another MThing).

Figure 1 shows the process to discover MThings in the network by a required capability. Each MThing, which supports the required capability, can send back its information. In the figure, an MThing broadcasts a message using `discoverMThingByCapability()` to look for MSensors that are capable of capturing an audio (Figure 1, item 1). Each MSensor (e.g. MMicrophone1, MMicrophone2, MCamera1) sends back its information using `sendBackMThingInfo()`, which returns the data format `MThingInfo` specified in ISO/IEC 23093-3³ (Figure 1, item 2).

Figure 2 shows the process of connecting MThings with a capability. An MThing (i.e. ReqMThing) can ask the availability of the specific capability (e.g. `SENSOR_CAPTURE_AUDIO`) with the function `isCapabilityAvailable()` to another MThing (Figure 2, item 1). If the capability “`SENSOR_CAPTURE_AUDIO`” is currently unavailable, the MThing (i.e. MMicrophone1) notifies “unavailable” (Figure 2, item 2). The ReqMThing can ask the availability of the specific capability again to other MThings (Figure 2, item 3) with the binary representation of “MSensor” and “`SENSOR_CAPTURE_AUDIO`”. Because the MCamera1 notifies the ReqMThing that its “`SENSOR_CAPTURE_AUDIO`” capability is available (Figure 2, item 4), the ReqMThing can connect to the camera and reserve its “`SENSOR_CAPTURE_AUDIO`” capability (Figure 2, item 5). As long as the capability “`SENSOR_CAPTURE_AUDIO`” of the MCamera1 is used by the ReqMThing, other MThings cannot access the corresponding capability.

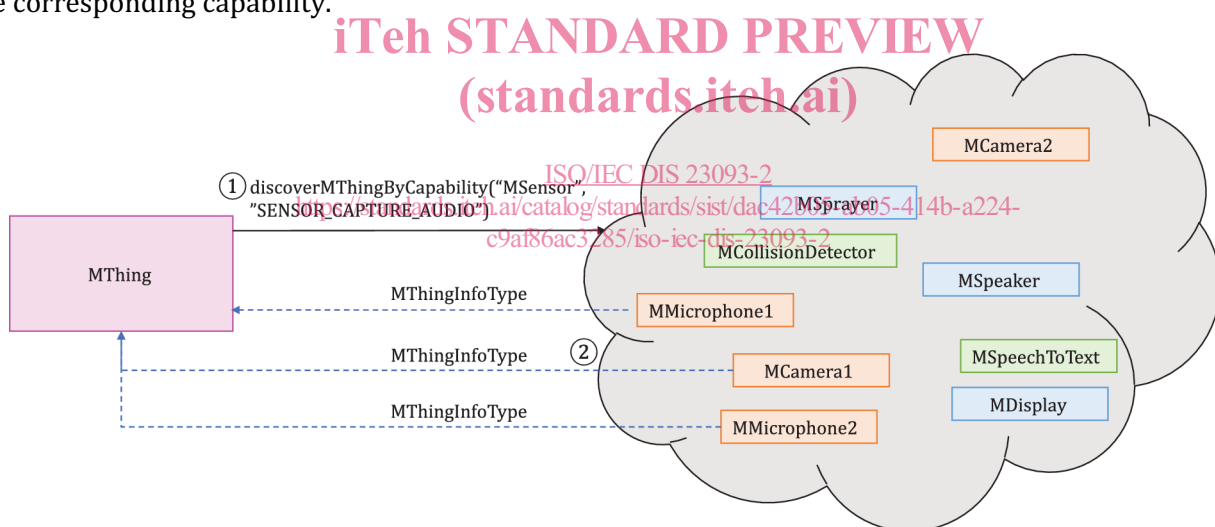


Figure 1 — Discovering MThings by capability

³ Under preparation. Stage at time of publication: ISO/IEC FDIS 23093-3:2019.

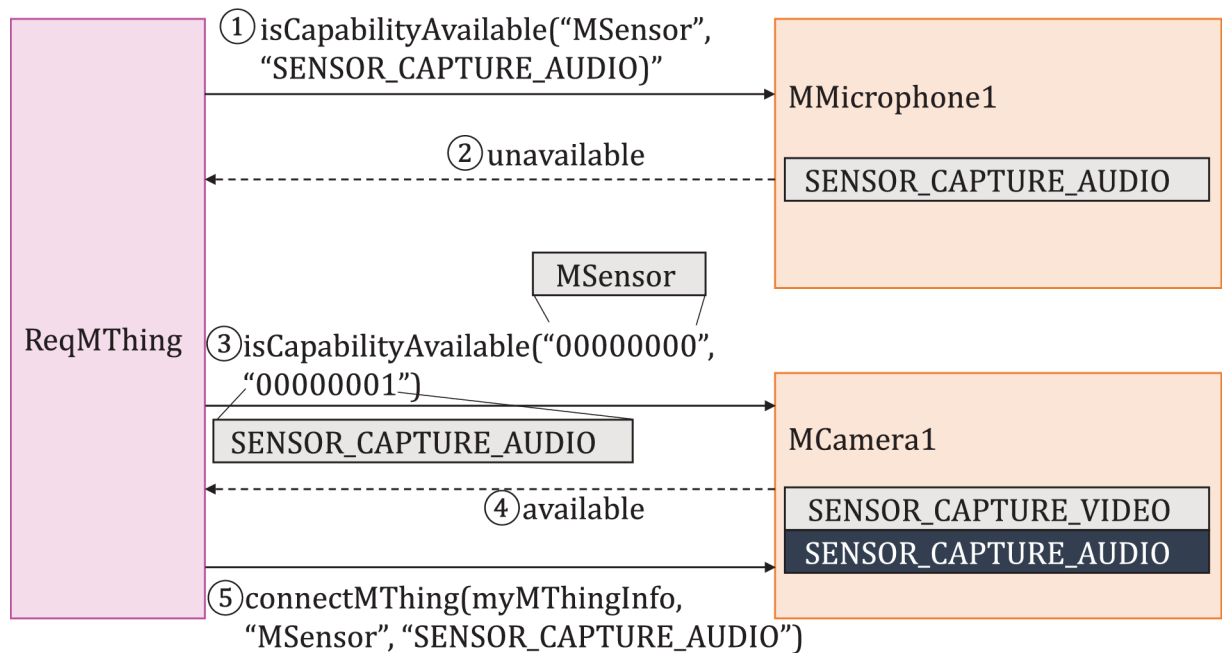


Figure 2 — Connecting MThings based on a capability

Figure 3 shows the process of disconnecting (i.e. releasing capabilities of) an MThing. The ReqMThing can release either all of its reserved capabilities of the MCamera (Figure 3, items 1 and 2) or a designated capability (e.g. SENSOR_CAPTURE_AUDIO) (Figure 3, items 3 and 4) using disconnectMThing().

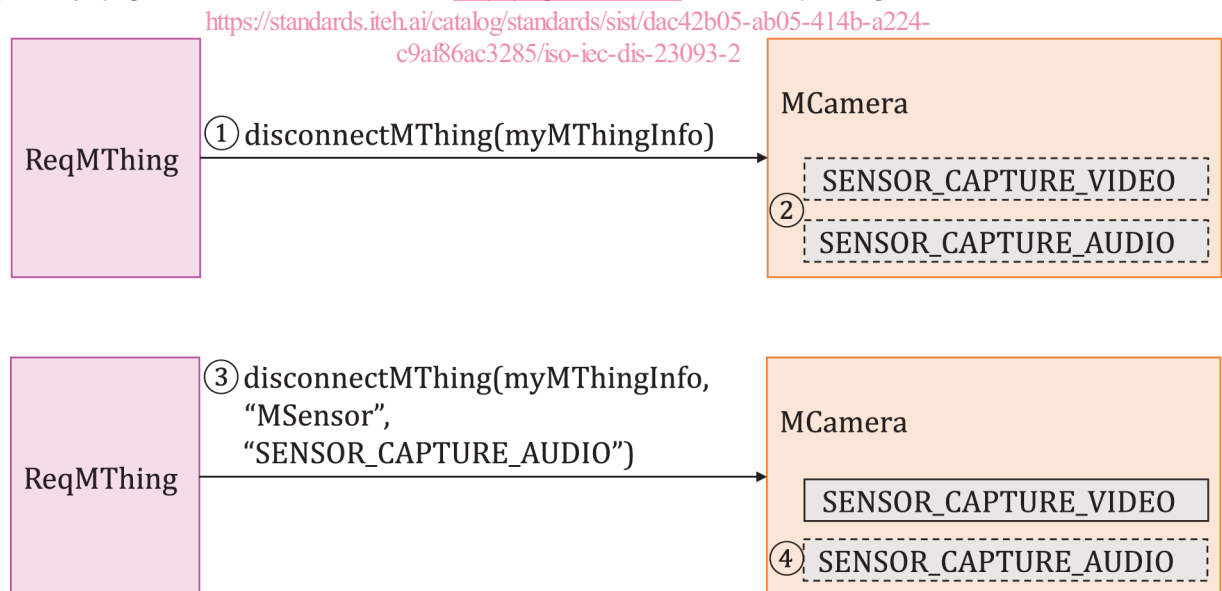


Figure 3 — Disconnecting an MThing

Figure 4 shows the process where an MThing alerts other MThings that all or some of its capabilities are going to be unavailable. The MCamera can alert the MThing_01 that either all of the capabilities reserved by MThing_01 are unavailable (Figure 4, items 1 and 2) or a designated capability (e.g. SENSOR_CAPTURE_AUDIO) is no longer available to MThing_01 (Figure 4, items 3 and 4) using alertDisconnection().

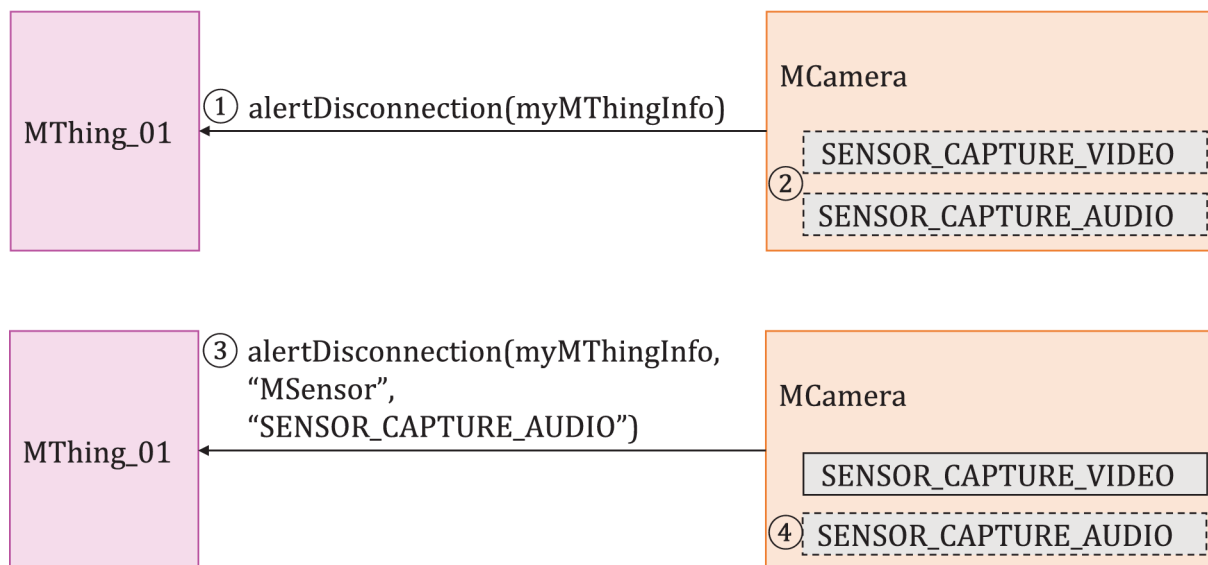


Figure 4 — Alerting disconnection to an MThing

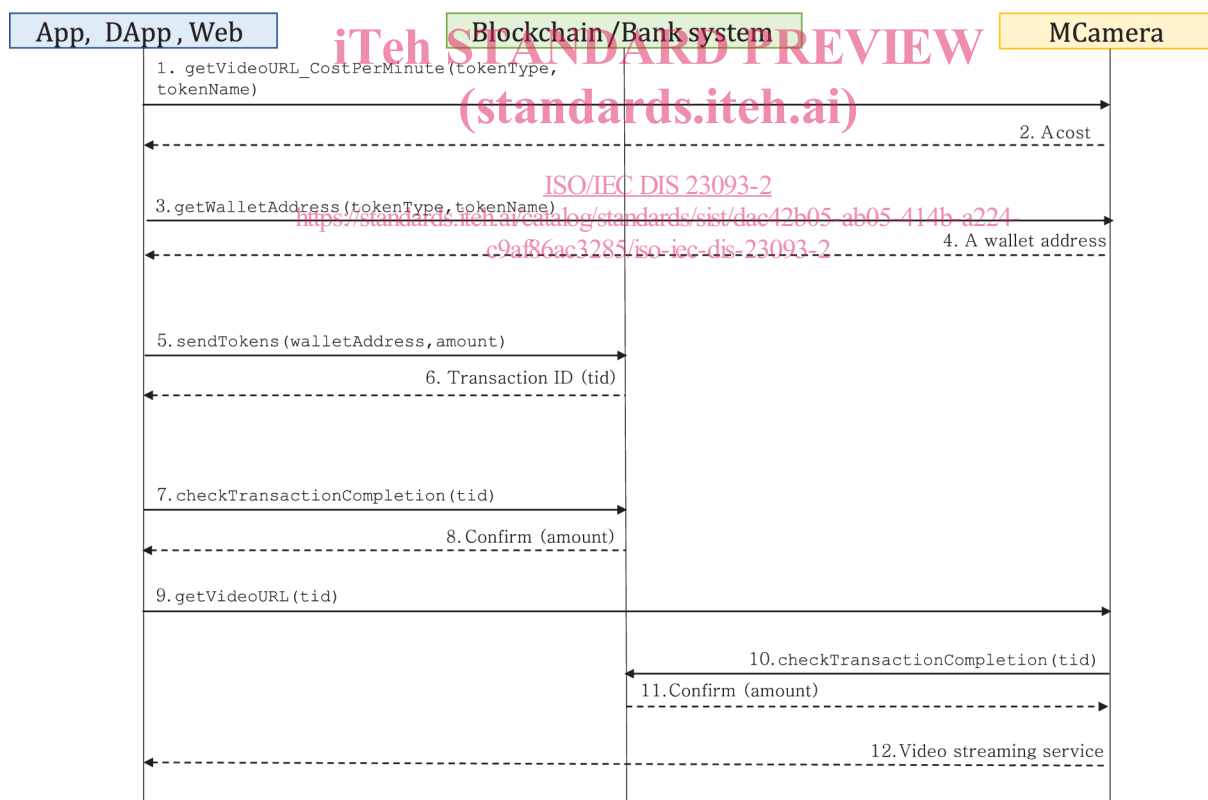


Figure 5 — Transaction process between a user and an MThing

Figure 5 shows a sequence diagram of a transaction process between a user and an MThing. Suppose that a user wants to watch a video captured from a nearby camera (i.e. MCamera). The user asks a cost per minute to watch a video taken by the MCamera using `getVideoURL_CostPerMinute()` through their user interface of Apps, DApps, or Web (Figure 5, item 1) with desired media token defined by `tokenType` (e.g. cryptocurrency or legal tender) and `tokenName` (e.g. Bitcoin or US dollar). The

MCamera returns the cost per minute to let the user use the `getVideoURL()` function (Figure 5, item 2). If the user wants to watch the video with the responded price, they ask a wallet address (Figure 5, item 3) of the desired MToken. Again, the MCamera responds with the proper wallet address (Figure 5, item 4). The user sends some amount of MTokens to the wallet address through a payment system like a blockchain or a banking system (Figure 5, item 5) which returns a transaction ID (Figure 5, item 6). With this transaction ID (i.e. `tid`), the user can confirm (Figure 5, item 8) whether the token transaction was completed to the designated wallet address or not (Figure 5, item 7) using `checkTransactionCompletion(tid)`. Once the transaction is confirmed, the user can ask for the video stream service to the MCamera using `getVideoURL(tid)` (Figure 5, item 9). The MCamera checks for the completion of the token transaction using `checkTransactionCompletion(tid)` (Figure 5, item 10) and the amount of MTokens received (Figure 5, item 11). The MCamera returns a video URL and streams the video as much as the user paid (Figure 5, item 12). The details of APIs, `getVideoURL_CostPerMinute()` and `getVideoURL()` are given in ISO/IEC 23093-3.

Figure 6 shows a sequence diagram of a transaction process between MThings. Suppose that a camera (i.e. MCamera) wants to stream a captured video to a nearby display (i.e. MDisplay) and play it. The MCamera asks a cost per minute to play a video on the MDisplay using `setVideoURL_CostPerMinute()` (Figure 6, item 1) with desired media token defined by `tokenType` (e.g. cryptocurrency or legal tender) and `tokenName` (e.g. Bitcoin or US dollar). The MDisplay returns the cost per minute to use the `setVideoURL()` function (Figure 6, item 2). If the MCamera wants to play the video with the responded price, it asks a wallet address (Figure 6, item 3) of the desired MToken. Again, the MDisplay reponses with the proper wallet address (Figure 6, item 4). The MCamera sends some amount of MTokens to the wallet address through a payment system like a blockchain or a banking system (Figure 6, item 5) which returns a transaction ID (Figure 6, item 6). With this transaction ID (i.e. `tid`), the MCamera can confirm (Figure 6, item 8) whether the token transaction was completed to the designated wallet address or not (Figure 6, item 7) using `checkTransactionCompletion(tid)`. Once the transaction is confirmed, the MCamera can ask for the video play service to the MDisplay using `setVideoURL(tid, url)` (Figure 6, item 9). The MDisplay checks for the completion of the token transaction using `checkTransactionCompletion(tid)` (Figure 6, item 10) and the amount of MTokens received (Figure 6, item 11). The MDisplay plays the video using the received video URL as much as the MCamera paid and notifies the completion of the video playing service (Figure 6, item 12). The details of APIs, `setVideoURL_CostPerMinute()` and `setVideoURL()` are given in ISO/IEC 23093-3.