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**Information technology — MPEG  
extensible middleware (MXM) —**

**Part 4:  
MXM protocols**

*Technologies de l'information — Intergiciel MPEG extensible (MXM) —*

*Partie 4: Protocoles MXM*

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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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 23006-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This first edition of ISO/IEC 23006-4 cancels and replaces ISO/IEC 29116-1:2008.

ISO/IEC 23006 consists of the following parts, under the general title *Information technology — MPEG extensible middleware (MXM)*:

- *Part 1: MXM architecture and technologies*
- *Part 2: MXM API*
- *Part 3: MXM conformance and reference software*
- *Part 4: MXM protocols*

## Introduction

ISO/IEC 23006 is a suite of standards that has been developed for the purpose of enabling the easy design and implementation of media-handling value chains whose devices interoperate because they are all based on the same set of technologies accessible from the MXM middleware.

This will enable the development of a global market of

- MXM applications that can run on MXM devices thanks to the existence of a standard MXM application API,
- MXM devices executing MXM applications thanks to the existence of a standard MXM architecture,
- MXM engines thanks to the existence of standard MXM architecture and standard APIs, and
- innovative business models because of the ease to design and to implement media-handling value chains whose devices interoperate because they are all based on the same set of technologies, especially WG11 technologies.

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# Information technology — MPEG extensible middleware (MXM) —

## Part 4: MXM protocols

### 1 Scope

This part of ISO/IEC 23006 specifies a set of protocols enabling distributed applications to exchange information related to content items and parts thereof, including rights and protection information.

This part of ISO/IEC 23006 specifies five categories of protocols: the content protocols, the license protocols, the IPMP tool protocols, the domain protocols and the event report protocols. The first category includes protocols to access, authenticate, identify and store a content item or parts thereof. The second includes protocols to access and store a license from/to a remote service. The third category includes protocols to access an IPMP tool (a module performing protection operations such as decryption, watermarking, key management, etc.) from a remote service while a fourth category includes the protocols allowing a number of devices to create, join, administer, etc. a group of users and devices where the participants share common properties. The fifth category, event report, comprises the protocol to store an event report and the protocol to register an event report request.

In security-aware environments, the security at the communication level is assumed to be handled by traditional underlying security protocols, e.g. the SSLv3 or TLSv1 protocols. This part of ISO/IEC 23006 does not apply to this level. Figure 1 shows the scope of the MXM protocols.

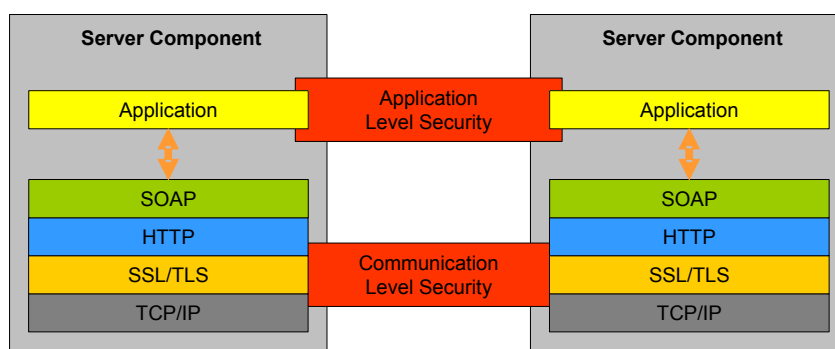


Figure 1 — Scope of MXM protocols

### 2 Normative references

The following referenced documents are indispensable for the application 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 23006-1, *Information technology — MPEG extensible middleware (MXM) — Part 1: MXM architecture and technologies*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 23006-1 apply.

### 4 Abbreviated terms

DID	Digital Item Declaration
DIDL	Digital Item Declaration Language
DII	Digital Item Identification
DMD	Domain Management Device
DoID	Domain Identification Device
IPMP	Intellectual Property Management and Protection
URI	Uniform Resource Identifier

### 5 Namespace conventions

Throughout this part of ISO/IEC 23006, Qualified Names are written with a namespace prefix followed by a colon followed by the local part of the Qualified Name.

For clarity, throughout this part of ISO/IEC 23006, consistent namespace prefixes are used. Table 1 gives these prefixes and the corresponding namespace.

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**Table 1—Namespaces and prefixes**

Prefix	Corresponding namespace
didl	urn:mpeg:mpeg21:2002:02-DIDL-NS
didmodel	urn:mpeg:mpeg21:2002:02-DIDMODEL-NS
didl-msx	urn:mpeg:maf:schema:mediastreaming:DIDLextensions
dii	urn:mpeg:mpeg21:2002:01-DII-NS
dsig	http://www.w3.org/2000/09/xmlsig#
ipmpdidl	urn:mpeg:mpeg21:2004:01-IPMPDIDL-NS
ipmpmsg	urn:mpeg:mpeg21:2006:07-IPMPMESSAGES-NS
ipmpinfo	urn:mpeg:mpeg21:2004:01-IPMPINFO-NS
m1x	urn:mpeg:mpeg21:2005:01-REL-M1X-NS
mxmacp	urn:mpeg:mpeg-m:schema:accesscontentprotocol:2009
mxmaitp	urn:mpeg:mpeg-m:schema:accessipmptoolprotocol:2009
mxmalp	urn:mpeg:mpeg-m:schema:accesslicenseprotocol:2009
mxmaucp	urn:mpeg:mpeg-m:schema:authenticatecontentprotocol:2009
mxmbp	urn:mpeg:mpeg-m:schema:baseprotocol:2009
mxmd	urn:mpeg:mpeg-m:schema:domain:2009
mxmdp	urn:mpeg:mpeg-m:schema:domainprotocol:2009

mxmicp	urn:mpeg:mpeg-m:schema:identifycontentprotocol:2009
mxmrlp	urn:mpeg:mpeg-m:schema:revokelicenseprotocol:2009
mxmscp	urn:mpeg:mpeg-m:schema:storecontentprotocol:2009
mxmslp	urn:mpeg:mpeg-m:schema:storelicenseprotocol:2009
r	urn:mpeg:mpeg21:2003:01-REL-R-NS
sx	urn:mpeg:mpeg21:2003:01-REL-SX-NS
xsd	http://www.w3.org/2001/XMLSchema
xsi	http://www.w3.org/2001/XMLSchema-instance

## 6 System overview

ISO/IEC 23006-1 specifies the format of the data exchanged between distributed applications part of media-handling value chains as shown in the figure below.

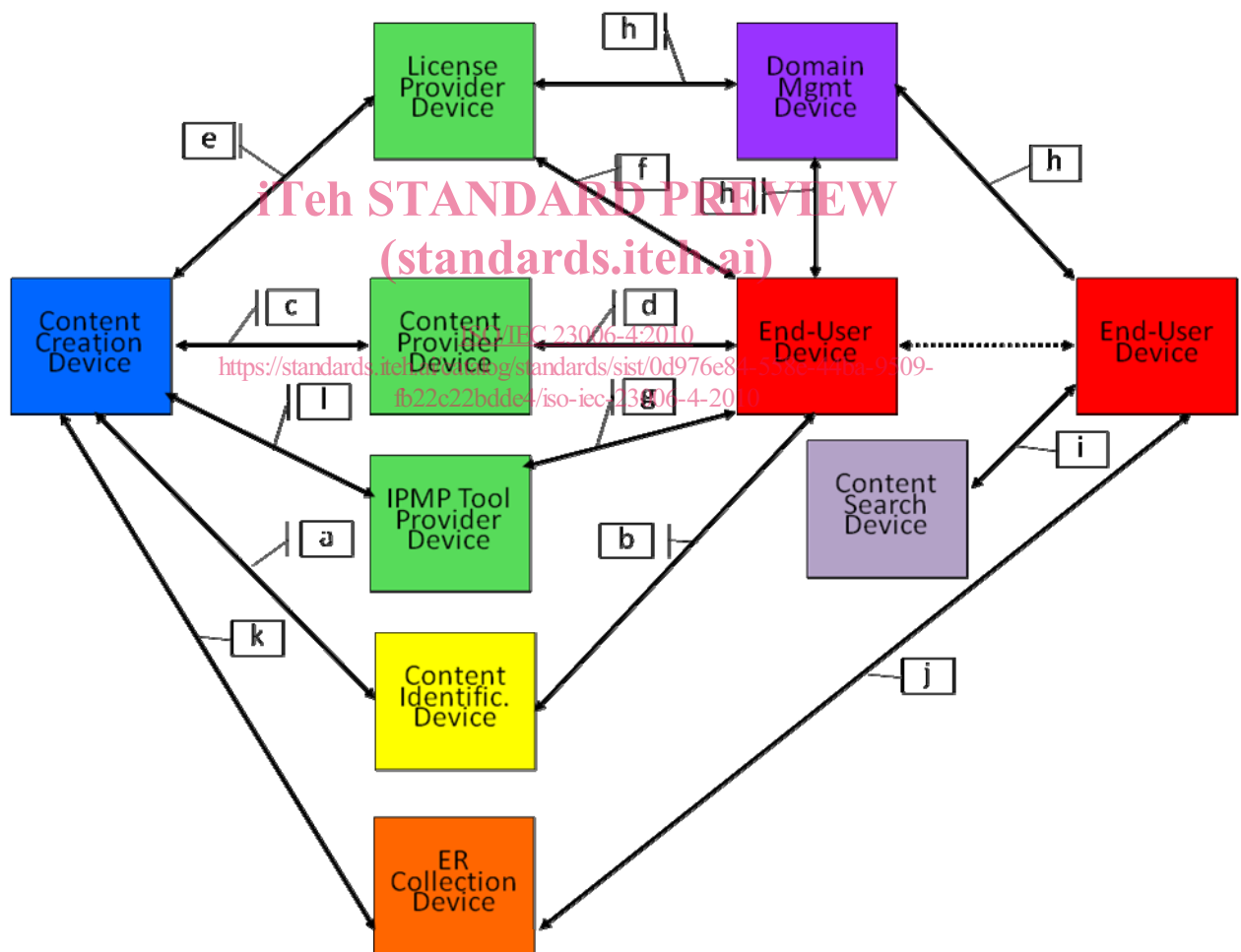


Figure 2 — Typical devices in a media-handling value chain

The devices in Figure 1 are defined as following:

- Content Creation Device, a device capable of creating content items possibly including audio-visual resources, metadata, rights information, etc.

- Content Provider Device, a device capable of storing content and in turn providing it to other devices (e.g. via streaming, downloading, etc.).
- License Provider Device, a device capable of being configured to issue licenses to other devices upon request.
- IPMP Tool Provider Device, a device capable of interacting with other devices to provide IPMP Tools.
- Content Identification Device, a device capable of providing identifiers to new content items and parts thereof, and allowing applications to verify the authenticity of the identified objects.
- Domain Management Device, a device capable of managing various functions needed for a proper functioning of a domain.
- End-User Device, a device capable of accessing content, licenses and IPMP Tools from other devices, authenticating content and becoming part of a domain of devices.
- Event Report Collecting Device, a device capable of processing ER-R and issue ER.
- Content Search Device, a device providing other devices with responses to queries.

The Protocols specified by this International Standard are identified in Figure 1 with a number representing the following:

**Table 2 — List of MXM Protocols**  
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#	Protocol name	Purpose
a	Identify Content Protocol	to identify content items and elements thereof, as specified in 8.1
b	Authenticate Content Protocol	to authenticate content items and elements thereof, as specified in 8.2
c	Store Content Protocol	to store content items and elements thereof, as specified in 8.3
d	Access Content Protocol	to obtain content items and elements thereof, as specified in 8.4
e	Store License Protocol	to configure a license service to issue licenses, as specified in 9.1
f	Access License Protocol	to obtain licenses granting rights over content items and elements thereof, as specified in 9.3
g	Access IPMP Tool Protocol	to obtain IPMP Tools necessary to access protected content, as specified in 10.1
h	Manage Domain Protocol	to create, join, administer, etc. a group of users and devices, as specified in 11
i	Content Search Protocol	to perform searches for content items having specific characteristics, as specified in ISO/IEC 15938-12
j	Store Event Report Protocol	to request the ECD to store an Event Report, as specified in 12.2.2
k	Register Event Report Request	to request the ECD to register a class of Event Reports triggered by a certain Event Report Request, as specified in 12.2.1
l	Access IPMP Tool List Protocol	to request the list of IPMP Tool Bodies available on the TPD, as specified in 10.2

The Protocols listed above are divided in five categories: Content Protocols, comprising of a), b), c), d) and i, License Protocols comprising of e) and f), IPMP Tool Protocols comprising of g) and l), Manage Domain Protocols comprising of h), “and “Event Report” comprising of j), k)

The messages exchanged between two devices are based on a transactional protocol that is supported over an existing network protocol (e.g. TCP/IP or HTTP in the case of Internet/WWW access).

## 7 Base Protocol

### 7.1 Introduction

This Clause specifies the base information commonly used in both the MXM protocols. The namespace *mxmbp* defines the elements on which the access protocols and the domain protocols are based.

### 7.2 Protocol data format

#### 7.2.1 ProtocolBaseType

The *mxmbp:ProtocolBaseType* abstract complex type is defined in the figure below. All the complex types defined in this standard extends *mxmbp:ProtocolBaseType*.

```
<complexType name="ProtocolBaseType" abstract="true"/>
```

Figure 3 — The *mxmbp:ProtocolBaseType* complex type

#### 7.2.2 ProtocolType

The abstract *mxmbp:ProtocolType* complex type, defined in the figure below, extends the *mxmbp:ProtocolBaseType* for conveying the *mxmbp:TransactionID* element which conveys a value which is used to track a message exchange session. Any message in response to another message shall specify the same *TransactionID* value contained in the request.

```
<complexType name="ProtocolType" abstract="true"/>
  <complexContent>
    <extension base="mxmbp:ProtocolBaseType">
      <sequence>
        <element name="TransactionID" type="string"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>
```

Figure 4 — The *mxmbp:ProtocolType* complex type

#### 7.2.3 Ack

The *mxmbp:Ack* element defined in the figure below extends the *mxmbp:ProtocolType* complex type by specifying a boolean attribute, *Result*, which shall indicate whether the protocol was carried out with success or otherwise, and the *mxmbp:ProtocolResult* element, that may convey further information concerning the result of an operation.

```

<element name="Ack" type="mxmbp:AckType" />
<complexType name="AckType">
  <complexContent>
    <extension base="mxmbp:ProtocolType">
      <sequence minOccurs="0">
        <element ref="mxmbp:ProtocolResult" />
      </sequence>
      <attribute name="Result" type="boolean" use="required" />
    </extension>
  </complexContent>
</complexType>

```

Figure 5 — The mxmbp:Ack element

#### 7.2.4 ProtocolResult

The ProtocolResult element may convey a result code indicating the result of a requested operation, and a string to display to the user indicating more information on the result of the operation.

```

<element name="ProtocolResult" type="mxmbp:ProtocolResultType" />
<complexType name="ProtocolResultType">
  <complexContent>
    <extension base="mxmbp:ProtocolBaseType">
      <sequence>
        <element name="ResultCode" type="mxmbp:ResultCodeType"
minOccurs="0" />
        <element name="DisplayString" type="string" minOccurs="0" />
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

Figure 6 — The mxmbp:ProtocolResult element

The ResultCode can be either one of those listed in Table 2 or it can be a new value extending the ExtendableResultCodeType simpleType.

```

<complexType name="ResultCodeType">
  <complexContent>
    <extension base="mxmbp:ProtocolBaseType">
      <sequence>
        <choice>
          <element name="BasicResultCode"
type="mxmbp:BasicResultCodeType" />
          <element name="ExtendableResultCode"
type="mxmbp:ExtendableResultCodeType" />
        </choice>
      </sequence>
    </extension>
  </complexContent>
</complexType>
<simpleType name="BasicResultCodeType">
  <restriction base="string">
    <enumeration value="OK" />
    <enumeration value="PERMISSION_DENIED" />
    <enumeration value="TIMEOUT" />
    <enumeration value="BUSY" />
    <enumeration value="MALFORMED_REQUEST" />
    <enumeration value="UNABLE_TO_PROCESS" />
    <enumeration value="OPERATION_NOT_SUPPORTED" />
    <enumeration value="UNKNOWN_MESSAGE" />

```

```

    <enumeration value="UNKNOWN_ERROR" />
  </restriction>
</simpleType>
<simpleType name="ExtendableResultCodeType">
  <restriction base="string" />
</simpleType>

```

**Figure 7 — The mxmbp:ResultCodeType complexType**

A list of result codes is given in the table below.

**Table 3 — List of Result Codes defined in the Base Protocol schema**

Result Code	Semantics
OK	The requested operation was carried out successfully
PERMISSION_DENIED	The sender is not allowed to carry out the requested operation
TIMEOUT	A timeout occurred while carrying out the requested operation
BUSY	The requested operation cannot be performed because the addressee is busy
MALFORMED_REQUEST	The request message is malformed or incomplete
UNABLE_TO_PROCESS	The requested operation is supported by the addressee, however the addressee is not able to process the request for an unknown reason
OPERATION_NOT_SUPPORTED	The requested operation is not supported by the addressee
UNKNOWN_MESSAGE	The sent message was not recognised by the addressee
UNKNOWN_ERROR	An unknown error occurred

### 7.2.5 ContentIdentifier

The ContentIdentifier element specified in the figure below conveys the identifier of a content item and optionally the identifier of a content element part of the content item. In the case the mxmbp:ContentElementIdentifier element is specified, only the specific content element is requested, and not the whole content item.

```

<element name="ContentIdentifier" type="mxmbp:ContentIdentifierType" />
<complexType name="ContentIdentifierType">
  <complexContent>
    <extension base="mxmbp:ProtocolBaseType">
      <sequence>
        <element name="ContentItemIdentifier" type="anyURI" />
        <element name="ContentElementIdentifier" type="anyURI"
minOccurs="0" />
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

**Figure 8 — The mxmbp:ContentIdentifier element**