
**Information technology — Multimedia
application format (MPEG-A) —**

**Part 16:
Publish/Subscribe Application Format**

*Technologies de l'information — Format des applications
multimedias —*

Partie 16: Format des applications Publier/Souscrire



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Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Abbreviated terms	5
5 PSAF reference model	5
6 PSAF schemas	8
6.1 General	8
6.2 PSAF DIDL profile schema	9
6.3 PSAF metadata schema	12
Annex A (informative) Example of Resource Information	14
Annex B (informative) Example of Publication Information	16
Annex C (informative) Example of Subscription Information	20
Annex D (informative) Example of Notification Information	22
Bibliography	27

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.

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 ISO documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology, SC 29, Coding of audio, picture, multimedia and hypermedia information*.

A list of all parts in the ISO/IEC 23000 series can be found on the ISO website.

Introduction

ISO/IEC 23000 (also known as “MPEG-A”) is a suite of MPEG standards designed to support a fast track to standardization of tested and verified technologies taken from the MPEG body of standards combined to form Multimedia Application Formats (MAF). If a needed piece of technology is not available within MPEG to achieve the desired format functionality, then additional technologies originating from other organizations may be included by reference.

The MAF defined by the Publish/Subscribe Application Format (PSAF) allows parties of the Publish/Subscribe (PubSub) communication model to support functionalities that are specific to publication, search and consumption of media content (in the following called Resource). The PubSub communication parties are:

- a) *Publishers*:
 - 1) create and store Resource Information (RI) on a publicly accessible location (e.g. an Information Centric Network);
 - 2) create and send Publications Information (PI) to Match Service Providers (MSP);
- b) *Subscribers*:
 - 1) create and send Subscriptions Information (SI) to Match Service Providers (MSP);
- c) *Match Service Providers (MSP)*:
 - 1) perform matches of Subscriptions with Publications;
 - 2) send Notification Information (NI) to users listed in PIs and SIs when a Match has been found;
- d) *Consumers*:
 - 1) receive Notification Information (NI);
 - 2) access the Resource present in or referenced by the Resource Information (RI).

NOTE In PubSub, senders do not communicate information directly to the intended receivers but rely on a service that mediates the sender-receiver relationship and sends notifications to relevant parties.

It should be noted that in PSAF, “Publisher” is not necessarily a user who distributes media to end users and “Subscriber” is not necessarily synonymous with end user or consumer. Indeed, in PSAF, Publisher may represent a user who has created a media item and wants to offer it to publishers and Subscriber may represent a publisher who is looking for media to be published and distributed.

PSAF specifies four formats — RI, PI, SI, and NI — to allow Publishers, Subscribers, Match Service Providers and Consumers to manage and control the way the information they exchange is used while trying to achieve their purposes.

The structure of the document is as follows:

[Clause 2](#) lists normative references. [Clauses 3](#) and [4](#) define the abbreviated terms and the terms used in this document. [Clause 5](#) specifies the PSAF reference model. [Clause 6](#) specifies the DIDL profile schema specific for PSAF and the PSAF Metadata Schema.

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Information technology — Multimedia application format (MPEG-A) —

Part 16: Publish/Subscribe Application Format

1 Scope

This document specifies four formats that are used by parties communicating using the Publish/Subscribe (PubSub) communication model for their multimedia communication purposes.

The PubSub parties are: Publisher, Subscriber, Match Service Provider (MSP) and Consumer and the formats employed are Resource Information (RI), Publication Information (PI), Subscription Information (SI) and Notification Information (NI).

This document specifies RI, PI, SI and NI in such a way that typical multimedia communication requirements can be supported. The following is a non-exhaustive list of such requirements.

- The Publisher can
 - describe the Resource for consumption purposes,
 - define the contract that will bind the Publisher and a Consumer,
 - request a device to report use of the Resource,
 - describe the Resource for distribution purposes,
 - define the contract that will bind the Publisher and a Match Service Provider (MSP) of a match involving the Publication, and
 - request the MSP to notify/not to notify a list of users.
- The Subscriber can
 - query the Resource,
 - define the contract that will bind the Subscriber and a Match Service Provider (MSP), and
 - request the MSP to notify/not to notify a list of users of a match involving the Subscription.

This document does not specify the protocols used to carry these payloads.

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 15938-3, *Information technology — Multimedia content description interface — Part 3: Visual*

ISO/IEC 15938-4, *Information technology — Multimedia content description interface — Part 4: Audio*

ISO/IEC 15938-5, *Information technology — Multimedia content description interface — Part 5: Multimedia description schemes*

ISO/IEC 15938-12, *Information technology — Multimedia content description interface — Part 12: Query format*

ISO/IEC 21000-2, *Information technology — Multimedia framework (MPEG-21) — Part 2: Digital Item Declaration*

ISO/IEC 21000-3, *Information technology — Multimedia framework (MPEG-21) — Part 3: Digital Item Identification*

ISO/IEC 21000-15, *Information technology — Multimedia framework (MPEG-21) — Part 15: Event Reporting*

ISO/IEC 21000-20, *Information technology — Multimedia framework (MPEG-21) — Part 20: Contract Expression Language*

ISO/IEC 21000-21, *Information technology — Multimedia framework (MPEG-21) — Part 21: Media contract ontology*

ISO/IEC 21000-22, *Information technology — Multimedia framework (MPEG-21) — Part 22: User Description*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 ISO/IEC 21000 series terminology

NOTE The terminology in this document is consistent with that in the ISO/IEC 21000 series, in particular with ISO/IEC 21000-2, ISO/IEC 21000-3, ISO/IEC 21000-15, ISO/IEC 21000-20 and ISO/IEC 21000-22. For readers not familiar with MPEG-21 terminology, the following definitions that are needed for PSAF are provided.

3.1.1 digital item identification DII

standard (ISO/IEC 21000-3) used by MPEG-21 for identification of digital item (3.1.4) and their components (3.1.5)

3.1.2 resource

individually identifiable asset such as a video or audio or audio-visual clip, an image, or a text

Note 1 to entry: All resources shall be locatable via a name or an address that is unambiguous in the context where the PubSub communication is performed.

3.1.3 container

structure that allows items (3.1.4) and/or containers to be grouped

Note 1 to entry: A container itself is not an item; containers are groupings of items and/or containers. Descriptors (3.1.6) allow for the "labelling" of containers with information appropriate for the purpose of the grouping.

3.1.4**item**

grouping of sub-items and/or *components* (3.1.5) that are bound to relevant *descriptors* (3.1.6)

Note 1 to entry: These descriptors contain information about the item. Items may contain choices, which allow them to be customized or configured. Items may be conditional (on predicates asserted by selections defined in the choices).

Note 2 to entry: An item that contains no sub-items can be considered a whole. An item that does contain sub-items can be considered a compilation. Items may also contain annotations to their sub-parts.

3.1.5**component**

binding of a *resource* (3.1.2) to a set of *descriptors* (3.1.6)

Note 1 to entry: These descriptors are information concerning all or part of the specific resource instance. A component itself is not an *item* (3.1.4); components are building blocks of items. Components may be conditional (see MPEG-21 DID for details).

3.1.6**descriptor**

information associated with the enclosing entity

Note 1 to entry: This information may be a *component* (3.1.5) (such as a thumbnail of an image or a text component) or a textual statement. Descriptors may be conditional (see MPEG-21 DID for details).

3.1.7**event report request**

request made to a device to send an *event report* (3.1.8) whenever a certain act is performed at the device

3.1.8**event report**

report sent by a device in response to an *event report request* (3.1.7) when the act specified by the ERR occurs

3.1.9**contract**

representation of agreements formed for the transaction of MPEG-21 Digital Items or services related to the MPEG-21 Framework

3.1.10**obligation**

deontic expression binding one of the parties to execute an Action

3.1.11**permission**

deontic expression allowing one of the parties to execute an Action

3.1.12**prohibition**

deontic expression binding one of the parties not to execute an Action

3.1.13**user description**

description of *user* (3.2.1) conforming to the MPEG-21 User Description standard

3.1.14**context description**

standard description of the context in which content is used

3.1.15

service description

standard description of the service provided by a Service Provider

3.1.16

recommendation description

standard format in which a recommendation is provided

3.2 PSAF user terminology

3.2.1

user

any one of *publisher* ([3.2.2](#)), *subscriber* ([3.2.3](#)), *match service provider* ([3.2.4](#)) and *consumer* ([3.2.5](#))

3.2.2

publisher

user ([3.2.1](#)) who creates and sends Publications to a *match service provider* ([3.2.4](#))

3.2.3

subscriber

user ([3.2.1](#)) who creates and sends Subscriptions to a *match service provider* ([3.2.4](#))

3.2.4

match service provider

MSP

user ([3.2.1](#)) who receives, and finds matches between Subscriptions and Publications, and notifies the match

3.2.5

consumer

user ([3.2.1](#)) who is notified by MSP of a potentially relevant *resource* ([3.1.2](#))

3.3 PSAF data set terminology

3.3.1

resource information

RI

data set related to the *resource* ([3.1.2](#))

3.3.2

publication information

PI

data set sent to selected MSP(s) in order to provide information on a certain *resource information* ([3.3.1](#))

3.3.3

subscription information

SI

data set sent to selected MSP(s) in order to query about *resource information* ([3.3.1](#)) satisfying specified criteria

3.3.4

notification information

NI

data set sent to *users* ([3.2.1](#)) specified in PI and SI containing information about the match between PI and SI

4 Abbreviated terms

CEL	MPEG-21 Contract Expression Language
DID	MPEG-21 Digital Item Declaration
DIDL	MPEG-21 Digital Item Declaration Language
DII	MPEG-21 Digital Item Identification
ER	MPEG-21 Event Report
ERR	MPEG-21 Event Report Request
MCO	MPEG-21 Media Contract Ontology
MSP	Match Service Provider
NI	Notification Information
PI	Publication Information
PSAF	Publish/Subscribe Application Format
PubSub	Publish/Subscribe
RI	Resource Information
SI	Subscription Information
UD	MPEG-21 User Description

5 PSAF reference model

The Publish/Subscribe communication paradigm, adapted to creation, publication and retrieval of media content, is represented by the workflow and [Figure 1](#) (note that the order in which publication and subscription are performed is not relevant).

- Publisher
 - Stores Resource (1)
 - Creates RI
 - Stores RI (2)
 - Creates PI
 - Publishes PI (3)
- Subscriber
 - Creates SI
 - Subscribes SI (4)
- Match Service Provider
 - Finds Match between SI and PI (5)

- Notifies Consumer (6)
- Consumer
 - Retrieves RI (7)
 - Retrieves and plays Resource (8)

NOTE Consumer is the user receiving NIs. It may or may not coincide with Subscriber or Publisher.

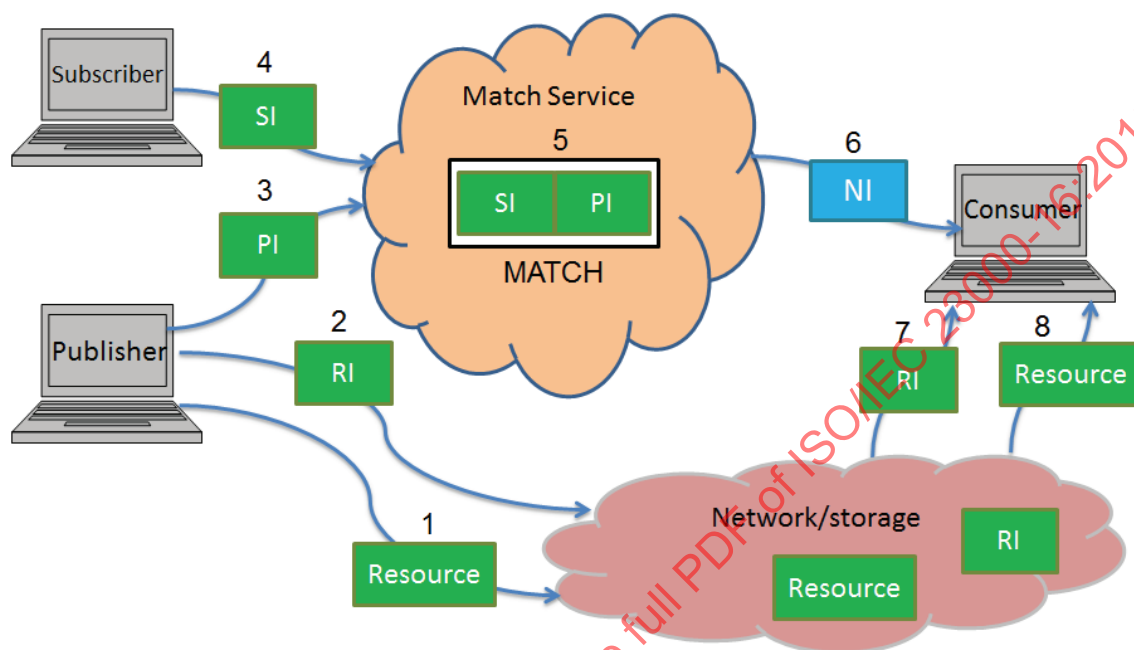


Figure 1 — Publish/Subscribe workflow for multimedia applications

From [Table 1](#), it can be seen that RI, PI and SI are represented as Digital Items and NI is represented as an Event Report.

Table 1 — Data formats, their components and standards used

Entity	Standard
RI	ISO/IEC 21000-2
Resource locator or name the RI refers to	
Metadata describing the Resource	ISO/IEC 15938-3, ISO/IEC 15938-4, ISO/IEC 15938-5
RI creator's ID	
Contract between Publisher and eventual Resource Consumer that includes	ISO/IEC 21000-20, ISO/IEC 21000-21
— IDs of Publisher	
— locator/name of Resource the contract refers to	
— permissions, obligations and prohibitions related to the use of the Resource	
Request to notify a list of User IDs that a specific use of a Resource has been made	ISO/IEC 21000-15
RI ID	ISO/IEC 21000-3
RI creator's signature	

Table 1 (continued)

Entity	Standard
PI	ISO/IEC 21000-2
RI ID the PI refers to	
Metadata related to publication	ISO/IEC 15938-3, ISO/IEC 15938-4, ISO/IEC 15938-5
Publisher ID	
Contract between Publisher and Match Service Provider that includes	ISO/IEC 21000-20, ISO/IEC 21000-21
— permission to match PI with SIs	
— permissions, obligations and prohibitions related to Subscriber ID	
— Match Service ID(s)	
Request to notify/not to notify a list of user IDs of a Match between a Publication and Subscriptions	ISO/IEC 21000-15
PI ID	ISO/IEC 21000-3
Publisher's signature	
SI	ISO/IEC 21000-2
Query	ISO/IEC 15938-12
Subscriber ID	
Metadata describing users of the sought-after Resource and context of use	ISO/IEC 21000-22
Contract between Subscriber and Match Service Provider that includes	ISO/IEC 21000-20, ISO/IEC 21000-21
— permission to	
— match SI with PIs	
— use query, metadata describing Subscriber and context, etc.	
— permissions, obligations and prohibitions related to Publisher ID	
— Match Service ID(s)	
Request to notify/not to notify a list of user IDs of a Match between a Subscription and Publications	ISO/IEC 21000-15
SI ID	ISO/IEC 21000-3
Subscriber's signature	
NI	ISO/IEC 21000-2
Notification	ISO/IEC 21000-15
RI ID	ISO/IEC 21000-3
Recommendation Description	ISO/IEC 21000-22
Match Service Provider's signature	

Figure 2 depicts the data (Digital Items and Event Reports) exchanged by users communicating according to this document. The numbers correspond to the steps of Figure 1. Note that UD = User Description, ERR = Event Report Request and RD = Recommendation Description.



6.1 General

PSAF utilizes the schemas defined in 6.2 and 6.3.

The used namespace prefixes together with their reference are given in [Table 2](#).

Table 2—Mapping of prefixes to namespaces in examples and text

Prefix	Corresponding namespace	Normative reference
Cd	urn:mpeg:mpeg-ud:2014:01-CD-NS	ISO/IEC 21000-22
cel-core	urn:mpeg:mpeg21:cel:core:2015	ISO/IEC 21000-20
cel-ipre	urn:mpeg:mpeg21:cel:ipre:2015	ISO/IEC 21000-20
Dcterms	http://purl.org/dc/terms/	
Didl	urn:mpeg:mpeg21:2006:07-DIDL-NS	ISO/IEC 21000-2
didmodel	urn:mpeg:mpeg21:2002:02-DIDMODEL-NS	ISO/IEC 21000-2
Dii	urn:mpeg:mpeg21:2002:01-DII-NS	ISO/IEC 21000-3
Ds	http://www.w3.org/2000/09/xmldsig#	
Dsig	http://www.w3.org/2000/09/xmldsig#	
Er	urn:mpeg:mpeg21:2005:01-ERL-NS	ISO/IEC 21000-15
Fo	http://www.w3.org/1999/XSL/Format	
ipmpinfo	urn:mpeg:mpeg21:2004:01-IPMPINFO-NS	

Table 2 (continued)

Prefix	Corresponding namespace	Normative reference
Media	http://search.yahoo.com/mrss/	
mpeg7	urn:mpeg:mpeg7:schema:2004	ISO/IEC 15938-5
Mpqf	urn:mpeg:mpqf:schema:2008	
Psaf	urn:mpeg:psaf:2015:01-PSAF-NS	Here
Rd	urn:mpeg:mpeg-rd:2014:01-RD-NS	ISO/IEC 21000-22
Sd	urn:mpeg:mpeg-ud:2014:01-SD-NS	ISO/IEC 21000-22
Ud	urn:mpeg:mpeg-ud:2014:01-UD-NS	ISO/IEC 21000-22
Xsi	http://www.w3.org/2001/XMLSchema-instance	

6.2 PSAF DIDL profile schema

The RI, PI and SI Digital Items and their components are expressed using the following standards:

- a) ISO/IEC 21000-2;
- b) ISO/IEC 21000-3;
- c) ISO/IEC 15938-3, ISO/IEC 15938-4 and ISO/IEC 15938-5;
- d) ISO/IEC 15938-12;
- e) ISO/IEC 21000-20;
- f) ISO/IEC 21000-21 (in contexts in which rights and contracts are expressed and managed according to the MCO format);
- g) ISO/IEC 21000-15;
- h) ISO/IEC 21000-22.

PI, RI, SI and NI are digitally represented as Digital Items using DIDL. The four Digital Items have a single *item* that coincides with one of the four principal elements of PSAF (PI, RI, SI and NI). Each *item* has an identifier that is an element *dii:identifier* or a descriptor. Each *item* is enriched with metadata of type *PSAFMetadata* that are specific of the three types of element, in particular they are metadata describing the resource (those of PI and RI) and a query conforming to the MPEG query format query (those of SI). PI and RI shall contain a resource: in the former case, the resource is an RI referenced by using an RI identifier, while in the latter, the resource is the resource that is the target of an eventual consumption, e.g. the URL of a Resource.

Digital Items and their elements are identified using DII.

CEL or MCO is used to digitally represent contracts between Publishers and MSPs, Subscribers and MSPs, and Publishers and Consumers.

ER is used to digitally represent requests issued to MSP to dispatch notifications to users.

Annexes A, B, C and D provide normative examples of RI, PI, SI and NI, respectively.

```
<?xml version="1.0"?>
<schema targetNamespace="urn:mpeg:mpeg21:2014:01-PSAF-DIDL-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="0.1" xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:didl="urn:mpeg:mpeg21:2006:07-DIDL-NS" xmlns:ud="urn:mpeg:mpeg-
ud:2014:01-UD-NS"
xmlns:cd="urn:mpeg:mpeg-ud:2014:01-CD-NS"
xmlns:psaf="urn:mpeg:mpeg21:2014:01-PSAF-NS"
xmlns:ipmpinfo="urn:mpeg:mpeg21:2004:01-IPMPINFO-NS"
xmlns:didmodel="urn:mpeg:mpeg21:2002:02-DIDMODEL-NS"
xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS"
xmlns:dsig="http://www.w3.org/2000/09/xmldsig#"
xmlns:er="urn:mpeg:mpeg21:2005:01-ERL-NS"
xmlns:cel-core="urn:mpeg:mpeg21:cel:core:2015"
xmlns:cel-ipre="urn:mpeg:mpeg21:cel:ipre:2015">

  <!--=====-->
  <attributeGroup name="ID_ATTRS">
    <attribute name="id" type="ID" use="optional"/>
  </attributeGroup>
  <element name="Item" type="didl:ItemType"
substitutionGroup="didmodel:Item"/>
  <complexType name="ItemType">
    <complexContent>
      <extension base="didmodel:ItemType">
        <sequence>
          <element ref="didmodel:Descriptor" maxOccurs="unbounded"/>
          <choice minOccurs="0" maxOccurs="unbounded">
            <element ref="didmodel:Item"/>
            <element ref="didmodel:Component"/>
          </choice>
        </sequence>
        <attributeGroup ref="didl:ID_ATTRS"/>
      </extension>
    </complexContent>
  </complexType>
  <element name="Component" type="didl:ComponentType"
substitutionGroup="didmodel:Component"/>
  <complexType name="ComponentType">
    <complexContent>
      <extension base="didmodel:ComponentType">
        <sequence>
          <element ref="didmodel:Resource" maxOccurs="unbounded"/>

```

```

        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <element name="Resource" type="didl:ResourceType"
substitutionGroup="didmodel:Resource"/>
  <complexType name="ResourceType" mixed="true">
    <complexContent mixed="true">
      <extension base="didmodel:ResourceType">
        <sequence>
          <any namespace="##any" processContents="lax"
minOccurs="0"/>
        </sequence>
        <attribute name="mimeType" type="string" use="required"/>
        <attribute name="ref" type="anyURI"/>
        <attribute name="encoding" type="string"/>
        <attribute name="contentEncoding" type="NMTOKENS"/>
      </extension>
    </complexContent>
  </complexType>
  <element name="Descriptor" type="didl:DescriptorType"
substitutionGroup="didmodel:Descriptor"/>
  <complexType name="DescriptorType">
    <complexContent>
      <extension base="didmodel:DescriptorType">
        <sequence>
          <element ref="didmodel:Statement"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>
  <element name="Statement" type="didl:StatementType"
substitutionGroup="didmodel:Statement"/>
  <complexType name="StatementType" mixed="true">
    <complexContent mixed="true">
      <extension base="didmodel:StatementType">
        <sequence>
          <choice>
            <element ref="dii:Identifier"/>
            <element ref="dii:RelatedIdentifier"/>
            <element ref="ipmpinfo:IPMPGeneralInfoDescriptor"/>
            <element name="ContentElementSignature"
type="dsig:SignatureType"/>
            <element name="Contract">
              <complexType>
                <choice>
                  <element ref="cel-core:contract"/>
                  <element name="MCOContractIRI" type="anyURI"/>
                </choice>
              </complexType>
            </element>
            <element ref="psaf:PSAFMetadata"/>
            <element ref="er:ERR"/>
            <element ref="er:ER"/>
          </choice>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

```

```

        <element name="UserDescription"
type="ud:UserDescriptionType"/>
        <element name="ContextDescription"
type="cd:ContextDescriptionType"/>
    </choice>
</sequence>
<attribute name="mimeType" type="string"/>
<attribute name="ref" type="anyURI"/>
</extension>
</complexContent>
</complexType>
</schema>

```

6.3 PSAF metadata schema

```

<?xml version="1.0"?>
<schema targetNamespace="urn:mpeg:psaf:2015:01-PSAF-NS"
elementFormDefault="qualified" attributeFormDefault="unqualified"
version="0.1"
xmlns="http://www.w3.org/2001/XMLSchema"
xmlns:psaf="urn:mpeg:mpeg21:2014:01-PSAF-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
xmlns:mpqf="urn:mpeg:mpqf:schema:2008"
xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS">
    <element name="PSAFMetadata" type="psaf:PSAFMetadataType"/>
    <complexType name="PSAFMetadataType">
        <sequence>
            <element name="InformationObjectCreator" type="anyURI"/>
            <choice>
                <element name="ResourceMetadata"
type="psaf:ResourceMetadataType"/>
                <element name="PublicationMetadata"
type="psaf:PublicationMetadataType"/>
                <element name="SubscriptionMetadata"
type="psaf:SubscriptionMetadataType"/>
            </choice>
        </sequence>
    </complexType>
    <complexType name="ResourceMetadataType">
        <sequence>
            <element ref="dii:Identifier" minOccurs="0"/>
            <choice>
                <element ref="mpeg7:Mpeg7"/>
                <any maxOccurs="1"/>
            </choice>
        </sequence>
    </complexType>
    <complexType name="PublicationMetadataType">
        <choice>
            <element name="contentBased">
                <complexType>
                    <sequence>
                        <element ref="dii:Identifier" minOccurs="0"/>
                        <choice>

```

```

        <element ref="mpeg7:Mpeg7"/>
        <any maxOccurs="1"/>
    </choice>
</sequence>
</complexType>
</element>
<element name="topicBased" type="string"/>
</choice>
</complexType>
<complexType name="SubscriptionMetadataType">
    <choice>
        <element name="contentBasedSubscription">
            <complexType>
                <sequence>
                    <element name="Query" type="mpqf:InputQueryType"/>
                </sequence>
            </complexType>
        </element>
        <element name="topicBasedSubscription" type="string"/>
    </choice>
</complexType>
</schema>

```

Annex A (informative)

Example of Resource Information

This example refers to a Resource Information containing a Resource identified by its DASH MPD ID.

```
<?xml version="1.0" encoding="UTF-8"?>

<didl:DIDL xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
xmlns:didl="urn:mpeg:mpeg21:2014:01-PSAF-DIDL-NS"
xmlns:didmodel="urn:mpeg:mpeg21:2002:02-DIDMODEL-NS"
xmlns:ds="http://www.w3.org/2000/09/xmldsig#"
xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:psaf="urn:mpeg:psaf:2015:01-PSAF-NS"
xmlns:cel-core="urn:mpeg:mpeg21:cel:contract:2011">

  <didl:Item id="A0">
    <didl:Descriptor>
      <didl:Statement mimeType="" ref="http://tempuri.org">
        <dii:Identifier>RIOObjectNumber1</dii:Identifier>
      </didl:Statement>
    </didl:Descriptor>
    <didl:Descriptor>
      <didl:Statement>
        <psaf:Metadata>

          <psaf:InformationObjectCreator>PublisherPeer</
psaf:InformationObjectCreator>

          <psaf:ResourceMetadata>
            <mpeg7:Mpeg7>
              <mpeg7:DescriptionMetadata>
                <mpeg7:LastUpdate>2015-10-08
15:44</mpeg7:LastUpdate>
                <mpeg7:Comment>
                  <mpeg7:FreeTextAnnotation>
                    Multimedia Metadata
                  </mpeg7:FreeTextAnnotation>
                </mpeg7:Comment>
                <mpeg7:Creator>
                  <mpeg7:Character>
                    <mpeg7:GivenName>
                      Giuseppe
                    </mpeg7:GivenName>
                    <mpeg7:FamilyName>
                      Vavala'
                    </mpeg7:FamilyName>
                  </mpeg7:Character>
                </mpeg7:Creator>
                <mpeg7:CreationLocation>
```

```

        <mpeg7:Name>
            Torino
        </mpeg7:Name>
        <mpeg7:GeographicPosition accuracy="100.0"
type="point">
            <mpeg7:Point altitude="100" latitude="7.65"
longitude="45.08"/>
        </mpeg7:GeographicPosition>
        </mpeg7:CreationLocation>
    </mpeg7:DescriptionMetadata>
    <mpeg7:Description xsi:type="ContentEntityType">
        <MultimediaContent xsi:type="VideoType">
            <Video>
                <Title>MyVideo1</Title>
            </Video>
        </MultimediaContent>
    </mpeg7:Description>
</mpeg7:Mpeg7>
</psaf:ResourceMetadata>
</psaf:Metadata>
</didl:Statement>
</didl:Descriptor>
<didl:Component>
    <didl:Resource mimeType="video/mp4"
ref="http://localhost:9080/videos/video1402493099290.mpd"/>
</didl:Component>
</didl:Item>
</didl:DIDL>

```

Annex B (informative)

Example of Publication Information

This example refers to a Publication Information containing a contract with a Match Service Provider giving permission to match PI with SIs and an Event Report Request containing the format of the Notification Information and a list of peers to be notified.

```
<?xml version="1.0" encoding="UTF-8"?>
<didl:DIDL xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
xmlns:didl="urn:mpeg:mpeg21:2014:01-PSAF-DIDL-NS"
xmlns:didmodel="urn:mpeg:mpeg21:2002:02-DIDMODEL-NS"
xmlns:ds="http://www.w3.org/2000/09/xmlsig#"
xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:psaf="urn:mpeg:psaf:2015:01-PSAF-NS" xmlns:cel-
core="urn:mpeg:mpeg21:cel:core:2015" xmlns:cel-
ipre="urn:mpeg:mpeg21:cel:ipre:2015" xmlns:err="urn:mpeg:mpeg21:2005:01-
ERL-NS">
  <didl:Item id="A0">
    <didl:Descriptor>
      <didl:Statement>
        <dii:Identifier>PIObjectNumber1</dii:Identifier>
      </didl:Statement>
    </didl:Descriptor>
    <didl:Descriptor>
      <didl:Statement>
        <err:ERR>
          <err:ERRDescriptor>
            <err:Lifetime><!-- The Peer is requested to monitor the
Event only at or after the specified StartTime -->
              <err:StartTime>2004-07-01T00:00:00</err:StartTime>
              <err:EndTime>2004-07-08T00:00:00</err:EndTime>
            </err:Lifetime>
            <err:Modification>
              <err:PeerId>Peer-publisher</err:PeerId>
              <err:Time>2004-06-30T18:015:00</err:Time>
              <err:Description>Creation
reference</err:Description>
            </err:Modification><!-- You can add more modification
--><!-- 0 is the highest priority -->
              <err:Priority>0</err:Priority>
            </err:ERRDescriptor>
            <err:ERSpecification><!-- Event report request identifier
-->
              <err:Identifier xmlns="urn:mpeg:mpeg21:2002:01-DII-NS">
urn:mpegRA:mpeg21:dii:cid:1702</err:Identifier><!-- Free description for
event report -->
```

```

        <err:ERDescription>Match ER</err:ERDescription><!--
Reccomendation description -->
        <err:ERFormatSpecification>

        <err:XMLschema>xmlns:rd="xmlns:psaf="urn:mpeg:mpeg21:2014:01-PSAF-
NS"</err:XMLschema>

        </err:ERFormatSpecification>
        <err:ERPayloadSpecification><!-- Identifier that will be
put in event report -->
        <err:ERIdentifier baseId="true">urn:is
bn:0-395-36341-1</err:ERIdentifier>
        <err:Time/><!-- The operation to Digital Item that
trigger the event report -->
        <err:DIOperation/>
        <err:DIMetadata>
        <err:DIMetadataElement tagName="EI-ID"/>
        </err:DIMetadata>
        </err:ERPayloadSpecification><!-- Peer's that will be
receive the event report -->
        <err:ERDeliverySpecification>
        <err:Recipient>
        <err:PeerId>Peer1</err:PeerId>
        </err:Recipient>
        <err:Recipient>
        <err:PeerId>Peer2</err:PeerId>
        </err:Recipient>
        <err:Recipient>
        <err:PeerId>Peer3</err:PeerId>
        </err:Recipient>
        </err:ERDeliverySpecification>
        <err:ERSpecification><!-- Condition that shall be satisfied
to trig the event -->
        <err:EventConditionDescriptor>
        <err:TimeCondition>
        <err:TimeEvent>
        <err:SpecificTime>
        <err:AfterOn>2005-01-01T00:00:00</err:AfterOn>
        <err:BeforeOn>2005-01-31T00:00:00</
err:BeforeOn>
        </err:SpecificTime>
        </err:TimeEvent>
        <err:Operator Name="OR"/>
        <err:TimeEvent>
        <err:PeriodicTime>
        <err:Start>2005-07-06T00:00:00</err:Start>
        <err:Period>P2M10D</err:Period>
        <err:Duration>P1D</err:Duration>
        <err:End>2006-07-06T00:00:00</err:End>
        </err:PeriodicTime>
        </err:TimeEvent>
        </err:TimeCondition>
        </err:EventConditionDescriptor>
        </err:ERR>

```

```

    </didl:Statement>
  </didl:Descriptor>
  <didl:Descriptor>
    <didl:Statement>
      <didl:PSAFMetadata>
        <psaf:InformationObjectCreator>
          PublisherPeer
        </psaf:InformationObjectCreator>
        <psaf:PublicationMetadata>
          <psaf:contentBased>

15:44<di:identifier>PublicationMetadataId</di:identifier>
          <mpeg7:Mpeg7>
            <mpeg7:DescriptionMetadata>
              <mpeg7:LastUpdate>2015-10-08
            </mpeg7:LastUpdate>
              <mpeg7:Comment>
                <mpeg7:FreeTextAnnotation>
                  Multimedia Metadata
                </mpeg7:FreeTextAnnotation>
              </mpeg7:Comment>
              <mpeg7:Creator>
                <mpeg7:Character>
                  <mpeg7:GivenName>
                    Giuseppe
                  </mpeg7:GivenName>
                  <mpeg7:FamilyName>
                    Vavala'
                  </mpeg7:FamilyName>
                </mpeg7:Character>
              </mpeg7:Creator>
              <mpeg7:CreationLocation>
                <mpeg7:Name>
                  Torino
                </mpeg7:Name>
                <mpeg7:GeographicPosition accuracy="100.0"
type="point">
                  <mpeg7:Point altitude="100"
latitude="7.65" longitude="45.08"/>
                </mpeg7:GeographicPosition>
              </mpeg7:CreationLocation>
            </mpeg7:DescriptionMetadata>
            <mpeg7:Description xsi:type="ContentEntityType">
              <MultimediaContent xsi:type="VideoType">
                <Video>
                  <Title>MyVideo1</Title>
                </Video>
              </MultimediaContent>
            </mpeg7:Description>
          </mpeg7:Mpeg7>
        </psaf:contentBased>
      </psaf:PublicationMetadata>
    </didl:PSAFMetadata>
  </didl:Descriptor>
</didl:Statement>

```

```

        </didl:Statement>
    </didl:Descriptor>
    <didl:Descriptor>
        <didl:Statement>
            <cel-core:Contract contractId="psaf annex B, Contract
example">
                <cel-core:Party id="PublisherPeer">
                    <cel-core:Person>
                        <cel-core:Name>Giuseppe Vavalà</cel-core:Name>
                    </cel-core:Person>
                </cel-core:Party>
                <cel-core:Party id="GreenMatchService">
                    <cel-core:Organization>
                        <cel-core:Name>The GreenICN official Match
Service</cel-core:Name>
                        <cel-core:Signatory>
                            <cel-core:Name/>
                            <cel-core:JobTitle/>
                        </cel-core:Signatory>
                    </cel-core:Organization>
                </cel-core:Party>
                <cel-core:Body>
                    <cel-core:OperativePart>
                        <cel-ipre:Permission id="match">
                            <cel-core:Subject partyRef="GreenMatchService"/>
                            <cel-core:Act>
                                <cel-core:Match/>
                            </cel-core:Act>
                            <cel-core:Object>
                                <cel-core:Item name="PublicationIdentifier">
                                    <dii:Identifier>PublicationMetadataId</dii:Identifier>
                                </cel-core:Item>
                            </cel-core:Object>
                            <cel-core:Constraint>
                                <cel-ipre:TemporalContext beforeDate="2001-11-
30T23:59:59" afterDate="2011-07-22T00:00:00"/>
                            </cel-core:Constraint>
                        </cel-ipre:Permission>
                    </cel-core:OperativePart>
                </cel-core:Body>
            </cel-core:Contract>
        </didl:Statement>
    </didl:Descriptor>
    <didl:Descriptor>
        <didl:Statement>
            <didl:Resource ref="idRI" mimeType="RI"/>
        </didl:Statement>
    </didl:Descriptor>
</didl:Item>
</didl:DIDL>

```

Annex C (informative)

Example of Subscription Information

This example refers to a Subscription Information containing a contract with a Match Service Provider giving permission to match SI with PIs and an Event Report Request containing the format of the Notification Information and a list of peers to be notified.

```
<?xml version="1.0" encoding="UTF-8"?>

<didl:DIDL xmlns:didl="urn:mpeg:mpeg21:2014:01-PSAF-DIDL-NS"
xmlns:didmodel="urn:mpeg:mpeg21:2002:02-DIDMODEL-NS"
xmlns:ds="http://www.w3.org/2000/09/xmlsig#"
xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:psaf="urn:mpeg:psaf:2015:01-PSAF-NS"
xmlns:cel-core="urn:mpeg:mpeg21:cel:contract:2011"
xmlns:mpqf="urn:mpeg:mpqf:schema:2008">

  <didl:Item id="A0">
    <didl:Descriptor>
      <didl:Statement mimeType="" ref="http://tempuri.org">
        <dii:Identifier>SIObjectNumber1</dii:Identifier>
      </didl:Statement>
    </didl:Descriptor>
    <didl:Descriptor>
      <didl:Statement>
        <didl:Metadata>
          <psaf:InformationObjectType>S-VDI</
psaf:InformationObjectType>
          <psaf:InformationObjectCreator>SubscriberPeer</
psaf:InformationObjectCreator>
          <psaf:SubscriptionMetadata>
            <psaf:contentBasedSubscription>
              <psaf:Query>
                <mpqf:QueryCondition>
                  <mpqf:Condition>
                    <mpqf:Condition xsi:type="mpqf:Equal">

<mpqf:StringField>State</mpqf:StringField>

<mpqf:StringValue>Italy</mpqf:StringValue>
                  </mpqf:Condition>
                </mpqf:Condition>
              </mpqf:QueryCondition>
            </psaf:Query>
          </psaf:contentBasedSubscription>
        </psaf:SubscriptionMetadata>
      </didl:Metadata>
    </didl:Statement>
  </didl:Descriptor>
</didl:Item>
</didl:DIDL>
```

```

    <cel-core:party id="GreenMatchService">
      <cel-core:organization>
        <cel-core:name>The GreenICN official Match Service</cel-core:name>
      </cel-core:organization>
    </cel-core:party>
    <cel-core:body>
      <cel-core:operativePart>
        <cel-core:deonticStructuredClause id="match">
          <cel-core:subject partyRef="MatchService">
            <cel-core:act>
              <cel-core:match/>
            </cel-core:act>
          <cel-core:object>
            <cel-core:item name="SubscriptionIdentifier">
              <dii:Identifier>SIObjectNumber1</dii:Identifier>
            </cel-core:item>
          </cel-core:object>
        </cel-core:deonticStructuredClause>
      </cel-core:operativePart>
    </cel-core:body>
  </cel-core:contract>
</didl:Statement>
</didl:Descriptor>
</didl:Item>
id1:DIDL>

```