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Information technology — Multimedia framework (MPEG-21) —

Part 15: Event Reporting

Technologies de l'information — Cadre multimédia (MPEG-21) —

Partie 15: Rapport d'événement

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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 21000-15 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 21000 consists of the following parts, under the general title *Information technology — Multimedia framework (MPEG-21)*:

— *Part 1: Vision, Technologies and Strategy* [Technical Report]

— *Part 2: Digital Item Declaration*

— *Part 3: Digital Item Identification*

— *Part 4: Intellectual Property Management and Protection Components*

— *Part 5: Rights Expression Language*

— *Part 6: Rights Data Dictionary*

— *Part 7: Digital Item Adaptation*

— *Part 8: Reference Software*

— *Part 9: File Format*

— *Part 10: Digital Item Processing*

— *Part 11: Evaluation Tools for Persistent Association Technologies* [Technical Report]

— *Part 12: Test Bed for MPEG-21 Resource Delivery* [Technical Report]

— *Part 14: Conformance Testing*

— *Part 15: Event Reporting*

— *Part 16: Binary Format*

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— *Part 17: Fragment Identification of MPEG Resources*

— *Part 18: Digital Item Streaming*

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Introduction

Today, many elements exist to build an infrastructure for the delivery and consumption of multimedia content. There is, however, no 'big picture' to describe how these elements, either in existence or under development, relate to each other. The aim for ISO/IEC 21000 is to describe how these various elements fit together. Where gaps exist, ISO/IEC 21000 will recommend which new standards are required. ISO/IEC JTC 1/SC 29/WG 11 (MPEG) will then develop new standards as appropriate while other relevant standards may be developed by other bodies. These specifications will be integrated into the multimedia framework through collaboration between MPEG and these bodies.

The result is an open framework for multimedia delivery and consumption, with both the content creator and content consumer as focal points. This open framework provides content creators and service providers with equal opportunities in the ISO/IEC 21000 enabled open market. This will also be to the benefit of the content consumer providing them access to a large variety of content in an interoperable manner.

The vision for ISO/IEC 21000 is to define a multimedia framework to enable transparent and augmented use of multimedia resources across a wide range of networks and devices used by different communities.

This part of MPEG-21 (ISO/IEC 21000-15) specifies Event Report Requests and Event Reports and how to use these in an ISO/IEC 21000 environment.

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Information technology — Multimedia framework (MPEG-21) —

Part 15:
Event Reporting

1 Scope

1.1 General

This part of ISO/IEC 21000 specifies

- how to express Event Report Requests (ER-R) that contain information about which Events to report, what information is to be reported and to whom;
- how to express Event Reports (ER) which are created by an MPEG-21 Peer in response to an Event Report Request when the conditions specified by an ER-R are met.

Event Reports Requests are used for specifying a set of conditions upon which a Peer will generate an Event Report and send it to a Recipient. Event Report Requests also specify what information is to be included in the resulting Event Report. The scope of Event Reporting is limited to reporting of Events between Peers, and does not include internal reporting of Events within a Peer.

1.2 Organisation of the Document

This part of ISO/IEC 21000 comprises nine clauses. This first clause provides scope and the organisation of the specification. Clauses 2 to 5.3 contain a set of references, terms and definitions and abbreviations.

Clause 6 introduces a high level architecture for Event Reporting, while clauses 7 and 8 specify the syntax and semantics of Event Report Requests, and Event Reports. Clause 9 then specifies the data types that are frequently used throughout this part of ISO/IEC 21000.

Finally, Annex A contains the XML Schema definition for the descriptors defined in clauses 7 and 8 and Annex B and Annex C provide examples of Event Report Requests and Event Reports.

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 21000 (all parts), *Information technology — Multimedia framework (MPEG-21)*

IETF RFC 3986, *Uniform resource identifier (URI): Generic syntax*, 2005

W3C, *XML Schema — Part 1: Structures*, Second edition, 2004

W3C, *XML Schema — Part 2: Datatypes*, Second edition, 2004

W3C, REC-xml-names-19990114, *Namespaces in XML*, 14 January 1999

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3 Terms and Definitions

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

3.1
Digital Item
structured digital object, including a standard representation, identification and meta-data within the MPEG-21 framework

NOTE This entity is the fundamental unit of distribution and transaction within the multimedia framework as a whole.

[ISO/IEC TR 21000-1:2004, definition 2.3]

3.2
Digital Item Declaration
declaration of the resources, metadata and their interrelationships of a Digital Item

NOTE See ISO/IEC TR 21000-2:2005.

3.3
Event
occurrence of a reportable activity

3.4
Event Report
representation of an Event(s) as specified by the related Event Report Request

3.5
Event Reporting
ISO/IEC 21000-15, which provides a means to exchange information about Events, between Peers

3.6
Event Report Request
request to report an Event(s)

3.7
Peer
device or application that compliantly processes a Digital Item

NOTE The term “Terminal” has been deliberately avoided because of its connotation as being the end point in a chain of communication. However, the term Peer explicitly also includes devices or applications that create or alter Digital Items.

[ISO/IEC TR 21000-1:2004, definition 2.7]

3.8
User
entity that interacts in the MPEG-21 environment or makes use of Digital Items

NOTE This includes all members of the value chain (e.g., creator, rights holders, distributors and consumers of Digital Items).

[ISO/IEC TR 21000-1:2004, definition 2.9]

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4 Symbols and Abbreviated Terms

DI
Digital Item

DID
Digital Item Declaration

DII
Digital Item Identification

ER
Event Report

ERL
Event Reporting Language

ER-R
Event Report Request

RDD
Rights Data Dictionary

REL
Rights Expression Language

URI
Uniform Resource Identifier [IETF RFC 3986]

URL
Uniform Resource Locator [IETF RFC 3986]

URN
Uniform Resource Name [IETF RFC 3986]

5 Namespace and Conventions

5.1 Namespace

The Event Reporting namespace shall be `urn:mpeg:mpeg21:2005:01-ERL-NS`.

5.2 Schema Wrapper

XML Schema declarations and definitions provided as XML fragments are to be understood as fragments of a complete schema and contained within an XML Schema schema element as follows:

```
<?xml version="1.0"?>
<!– Event Reporting ISO/IEC 21000-15 -->
<schema
 targetNamespace="urn:mpeg:mpeg21:2005:01-ERL-NS"
 xmlns="http://www.w3.org/2001/XMLSchema"
 xmlns:dip="urn:mpeg:mpeg21:2005:01-ERL-NS"
 elementFormDefault="qualified" attributeFormDefault="unqualified">
</schema>
```

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5.3 Use of namespace prefixes

Throughout this part of ISO/IEC 21000, Qualified Names are written with a namespace prefix followed by a colon followed by the local part of the Qualified Name as shown in the following example:

EXAMPLE `erl:EventReport`

For clarity, throughout this part of ISO/IEC 21000, consistent namespace prefixes are used. Table 1 gives these prefixes and the corresponding namespace.

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

Prefix	Namespace
`dia`	`urn:mpeg:mpeg21:2003:01-DIA-NS`
`didl`	`urn:mpeg:mpeg21:2002:02-DIDL-NS`
`dii`	`urn:mpeg:mpeg21:2002:01-DII-NS`
`dip`	`urn:mpeg:mpeg21:2005:01-DIP-NS`
`mx`	`urn:mpeg:mpeg21:2003:01-REL-MX-NS`
`r`	`urn:mpeg:mpeg21:2003:01-REL-R-NS`
`sx`	`urn:mpeg:mpeg21:2003:01-REL-SX-NS`
`mpeg7`	`urn:mpeg:mpeg7:schema:2004`
`xsd`	`http://www.w3.org/2001/XMLSchema`
`xsi`	`http://www.w3.org/2001/XMLSchema-instance`
NOTE The prefixes `xml` and `xmlns` are normatively defined by *Namespaces in XML (see W3C REC-xml-names-19990114)*. All other prefixes are informative and are used by convention for consistency in this part of ISO/IEC 21000.	

For informative examples provided as XML fragments without namespace declarations, the default namespace by convention in this part of ISO/IEC 21000 is defined as `urn:mpeg:mpeg21:2002:02-DIDL-NS` and the different prefixes are bound to the namespaces as listed above. It is to be understood that the appropriate namespace declarations would appear elsewhere in a complete XML document in which the example fragments are contained.

6 Reference Architecture

6.1 Background to Event Reporting

Event Reporting is required within the ISO/IEC 21000 Multimedia Framework in order to provide a standardised means for sharing information about Events amongst Peers and Users. Such Events relate to Digital Items and/or Peers that interact with them.

One example relates to the monitoring of the usage of copyrighted material. The provider offering Digital Items for download would specify in an Event Report Request that, whenever a Resource within a Digital Item is rendered (e.g. played), he would receive an Event Report enabling him to manage his royalties. Upon rendering, the Peer will generate an ISO/IEC 21000 Event Report which will be delivered to the rights holder specified, in an Event Report Request, containing information about the Digital Item, the Resource, and the conditions under which it has been rendered.

In another example, Event Reports are necessary for network nodes to know the exact connectivity condition between two Peers when trying to deliver Digital Items. While a network Peer may receive Digital Items from some Peers and forward them to other Peers in its network, the network Peer will monitor its load. When a

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critical threshold is reached, an Event Report may be created and sent to neighbouring network Peers who will in turn re-route their Digital Items to avoid the congested network Peer.

Fundamentally, Event Reporting in ISO/IEC 21000 will benefit Users by:

— Standardising metrics and interfaces for performance of all reportable events in MPEG -21;

— Providing a means of capturing and containing these metrics and interfaces that refers to identified Digital Items, Peers, and Users.

This part of ISO/IEC 21000 will facilitate Interoperability between Event consumers and creators, thereby enabling multimedia usage information to be both requested and represented in a normalized way. Examples where Event Reports may be requested include:

— Usage reports:

— Copyright reports:

  — Monitoring of Copies;

  — Monitoring of Performances;

  — Marketing information;

— Technical reports:

  — Bandwidth usage/availability;

  — Network congestion;

  — Load balancing;

— Financial reports:

  — Proof of purchase;

  — License purchase and delivery.

An Event Report Request (ER-R) is used to define the conditions (predicates) under which an Event is deemed to have occurred. Events defined by ER-Rs trigger the creation of an associated Event Report (ER), which contains information describing the Event, as specified in the associated ER-R.

Figure 1 depicts the general reference architecture for Event Reporting within ISO/IEC 21000. The architecture distinguishes five elements within a Peer that act upon receipt of an Event Report Request. These elements are:

— Event Report Request Receiver (responsible for receiving an Event Report Request from another Peer);

— Event Report Request Parser (responsible for interpreting an Event Report Request);

— Event Watchdog (responsible for monitoring Events and detecting when Event Report Request conditions have been fulfilled);

— Event Report Builder (responsible for assembling reportable Event data and creating an Event Report); and

— Event Report Dispatcher (responsible for taking an Event Report and sending it to the designated recipient Peers).

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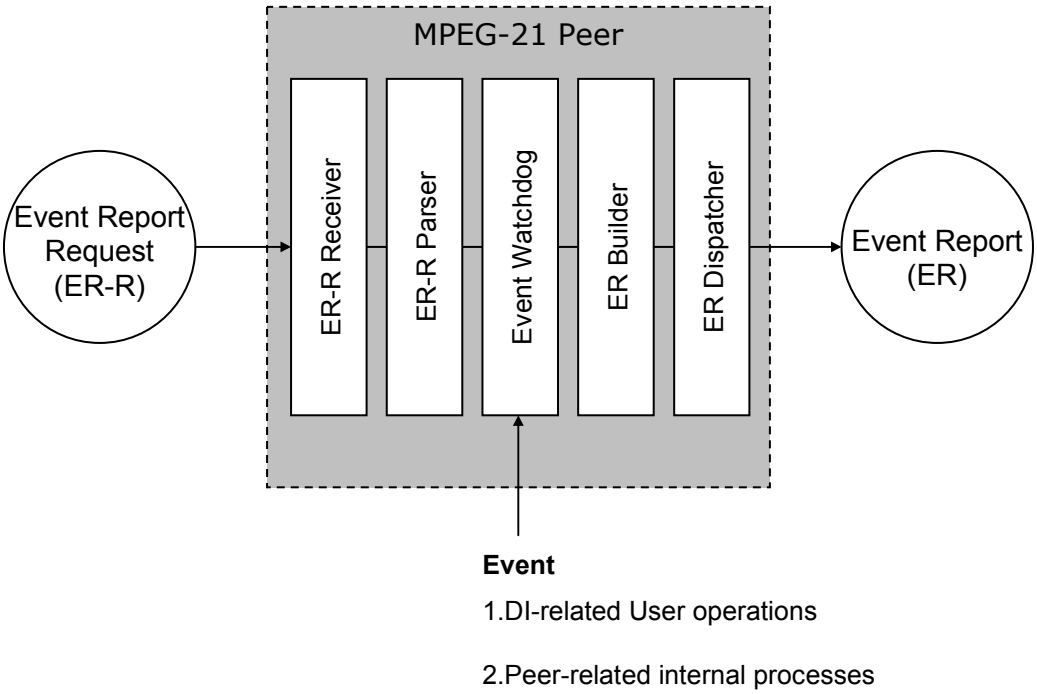

Figure 1 — Conceptual Diagram of Event Reporting

Event Reporting is used to report on the occurrence of Events which may be either directly or indirectly related either to a DI or a Peer. Note that it is not normative that an ER is only created as the result of ER-R processing. This means that applications may create Event Reports which are normative on their own initiative.

This part of ISO/IEC 21000 specifies the syntax and semantics of Event Report Requests and Event Reports and how they can be integrated with other parts of ISO/IEC 21000. Note that the functional blocks shown in Figure 1 of the general reference architecture are not normative.

6.2 Creating and Processing Event Reports

Within ISO/IEC 21000 Event Reporting there are two major classes of “reportable” Events:

a) Events which are generated as a result of User-related-operations on a specific instance of a Digital Item; and

b) Events which are generated within a Peer that are related to internal Peer processes.

The Events of type (a) only concern the usage of Digital Items. For example, when a Digital Item is played, this is considered to be a reportable Event as it deals exclusively with operations on a specific Digital Item instance.

In contrast, Events of type (b) are associated with a Peer, rather than a specific Digital Item instance. These Events concern Peer actions and do not need to be related to interaction with Digital Item instances. They can be the result of any internal Peer process. For example, when a Peer detects that it has lost network connectivity, falls into this category.

The handling of Peer-related Events is not currently specified in this part of MPEG-21.

An Event Report Request is defined by a User. It comprises of at least:

— A description of the Event;

— The syntax/format of the Event Report;

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— The recipient(s) of the Event Report;

— Parameters related to delivery of the Event Report (e.g. recipients or time of delivery mechanisms).

Upon the Event occurring, an Event Report may be generated and delivered to the specified recipient(s). The Event Report Request may specify that the generation and delivery of an Event Report is mandatory; this would be implemented using, for example, the Event Report Request as an “obligation” of a Rights Expression.

Event Reports, being Digital Items, will inherit their characteristics allowing identification, description and interaction with other parts of ISO/IEC 21000.

6.3 Relationship of Event Reporting with other Parts of ISO/IEC 21000

While it is possible to store and exchange Event Report Requests and Event Reports outside an ISO/IEC 21000 Digital Item this specification defines how Event Report Requests and Event Reports are contained within Digital Items, more specifically a Digital Item Declaration as defined in ISO/IEC 21000-2.

Both ER and ER-R’s may be represented within Digital Items, and therefore can natively inherit all of the properties of Digital Items.

When Event Reports Requests and Event Reports are packaged inside a Digital Item, they are encapsulated in *descriptor* elements.

A Digital Item may contain any number of Event Report Requests or Event Reports.

Event Report Request descriptors may be the only *descriptor* in a DI or may be provided alongside other resources.

The conditions associated with an ER-R, and the data items that can be reported within an ER may be retrieved from DIA Tools such as DIA’s Usage Environment Description Tool as defined in ISO/IEC 21000-7. Details on how this may be achieved is beyond the scope of this specification.

```
<!-- Example of an Event Report that is embedded inside a Digital Item -->

<didl:DIDL>
  <didl:Container>
    <didl:Item>
      <didl:Descriptor id="dii:ERRID">
       <didl:Statement mimeType="text/xml">
        <erl:ER id="ID000000">
         <erl:ERDescriptor/>
         <erl:ERData/>
        </erl:ER>
       </didl:Statement>
      </didl:Descriptor>
    </didl:Item>
  </didl:Container>
</didl:DIDL>
```

Figure 2 — Example of an Event Report embedded within a Digital Item

Where appropriate, Event Reporting will utilise other parts of ISO/IEC 21000. The syntax for referencing other parts of ISO/IEC 21000 is provided whenever necessary throughout the document.

In the referenced Digital Item, DIDL <Statement> elements may be referenced through the use of XPath. For example, a Statement element can be located via a sequence of location steps, based on the element tag names, e.g. `/DIDL/Item[2]/Descriptor[1]/Statement`.

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6.3.1 Identification of Event Report Requests and Event Reports

Event Report Requests and Event Reports may be embedded within Digital Items. When this is the case, it is possible to make use of ISO/IEC 21000-3 (Digital Item Identification) to identify both Event Report Requests and their related Event Reports using standard Digital Item Identification (DII) mechanisms. For example, if an Event Report Request (ER-R) is included inside a Digital Item's Item, then DII can be used to identify that ER-R. The same applies for Event Reports.

6.3.2 Access Control in Event Reporting

This optional clause specifies access rights which will apply to all ER-Rs, and all Event Reports that are generated as a result of processing an ER-R. This clause uses the REL language as defined by ISO/IEC 21000-5. The REL expression, if present, will be inserted at the top level of the Digital Item containing the Event Report Request or the Event Report.

```
<r:licenseGroup xmlns="urn:mpeg:mpeg21:2003:01-REL-R-NS"
  xsi:type="LicenseGroup">
    <mx:License>
      <mx:Grant>
        <mx:principal>Joe User</mx:principal>
        <mx:action>READ</mx:action>
        <mx:resource>
        <SelectionViaXPath>
             /Item/Descriptor/Title[Title='Hey Jude']
        </SelectionViaXPath>
        </mx:resource>
      </mx:Grant>
    </mx:License>
</r:licenseGroup>
```

EXAMPLE In this example, Joe User is granted the right to read a given element of the Event Report which is specified using XPath.

7 Event Report Requests

7.1 Introduction

As indicated in clause 6, the basic model of Event Reporting indicates that Events that need to be reported may be specified by interested parties through the use of an Event Report Request. The ER-R's purpose is to:

- describe the Event which is to be reported,
- indicate which Peers the Event should be reported to, and
- the data items that are to be included in such an Event Report(s).

The following subclauses provide details on the syntax and semantics of ER-Rs.

7.2 High-level Structure

Event Report Requests are composed of three main sections, where each main section comprises of several parts which are specified in the following subclauses.

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If an Event Report Request is packaged within a Digital Item, there are two elements that need to be inserted at the top level of the *item* which contains such an Event Report Request. This is before the Event Report Request Descriptor itself. These 2 elements are:

-Event Report Request identifier (as specified in subclause 6.3.1),
-Event Report Request access control information (as specified in subclause 6.3.2).

If an ER-R does not explicitly specify the items and/or resources that it concerns, its default scope then applies only to the item in which it has been declared. For example, if an ER-R is nested within a DI Item, its scope of validity is limited to the child elements of that Item.

7.2.1 Syntax

```
<!-- ######################################## -->
<!--       Definition of ER-R                 -->
<!-- ######################################## -->

<xsd:element name="ERR">

<xsd:complexType>
  <xsd:sequence>
    <xsd:element ref="erl:ERRDescriptor"/>
    <xsd:element ref="erl:ERSpecification"/>
    <xsd:element ref="erl:EventConditionDescriptor"/>
  </xsd:sequence>
</xsd:complexType>
```

7.2.2 Semantics

Name	Definition
ERR	Serves as the root element for describing an entire Event Report Request.
ERRDescriptor	Provides a description of the ER-R including aspects such as the Lifetime, Modifications and Priority level of the ER-R. See subclause 7.3 for a more detailed explanation.
ERSpecification	Provides a specification of the ER(s) which result from the processing of this ER-R. It contains aspects such as the Data items which are to be reported, the format in which they should be reported, details of any (optional) embedded ER-R, etc. See subclause 7.4 for a more detailed explanation.
EventConditionDescriptor	Provides a description of the conditions under which the ER-R is deemed to have occurred. This may relate to DI-Operation-based conditions or Peer-based conditions. See subclause 7.5 for a more detailed explanation.

7.2.3 Example

A complete example of an Event Report Request is provided in Annex B.

7.3 Event Report Request Descriptor

An Event Report Request Descriptor's purpose is to provide a mechanism to allow description of general ER-R parameters. It is in some ways analogous to a "header", often used in communications protocols, since it provides general parameters of the ER-R.

For example, each ER-R includes a lifetime specification, which is used to indicate a validity period for the specific ER-R. Such a parameter is general in nature and can be utilised by all ER-Rs.

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7.3.1 Syntax

```
<!-- ######################################## -->
<!--       Definition of ERRDescriptor        -->
<!-- ######################################## -->

<xsd:element name="ERRDescriptor">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="LifeTime" minOccurs="0" maxOccurs="1"/>
      <xsd:complexType>
       <xsd:sequence>
        <xsd:element name="StartTime" type="xsd:dateTime" />
        <xsd:element name="EndTime" type="xsd:dateTime" />
       </xsd:sequence>
      </xsd:complexType>
      <xsd:element name="Modification" type="erl:ModificationType"
maxOccurs="unbounded"/>
      <xsd:element name="Priority" minOccurs="0" maxOccurs="1" default="2"/>
       <xsd:simpleType>
        <xsd:restriction base="xsd:string">
         <xsd:enumeration value="0"/>
         <xsd:enumeration value="1"/>
         <xsd:enumeration value="2"/>
         <xsd:enumeration value="3"/>
         <xsd:enumeration value="4"/>
         <xsd:enumeration value="5"/>
        </xsd:restriction>
       </xsd:simpleType>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

7.3.2 Semantics

Name	Definition
ERRDescriptor	Describes a specific Event Report Request instance.
LifeTime	Defines the lifetime of the Event Report Request. This element is optional. When no LifeTime element is specified, Peers may elect to not process the ER-R as they see fit.
StartTime	Start of the ER-R's lifetime. The Peer is requested to monitor the Event only at or after the specified StartTime.
EndTime	End of the ER-R's lifetime. The Peer is requested to stop monitoring the Event after the specified EndTime. NOTE The Peer can either ignore or delete the ER-R.
Modification	Maintains the history of the Event Report Request. This element shall be used at least once to indicate the Date and Time of creation of the ER-R
Priority	Specifies the priority level for an ER-R. Priority levels are designated "0", "1", "2", "3", "4" and "5", ranging from highest priority to lowest. Event Report Requests should be processed according to their assigned priority. When two Event Report Requests have the same assigned priority, the Peer may make an arbitrary decision regarding the order in which they are processed. The default priority level is 2.

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7.3.3 Example

```
<ERRDescriptor>
  <LifeTime>
    <StartTime>2004-07-01T00:00:00</StartTime>
    <EndTime>2004-07-08T00:00:00</EndTime>
  </LifeTime>
  <Modification>
    <PeerId>GUID:1AC5-4527-A864-3EA2</PeerId>
    <UserId>CISAC:IPI:P-1435 6382</UserId>
    <Time>2004-06-30T18:015:00</Time>
    <Description>Creation reference</Description>
  </Modification>
  <Modification>
    <PeerId>GUID:54A9-32CA-9836-AC30</PeerId>
    <UserId>CISAC:IPI:P-1435 6382</UserId>
    <Time>2004-07-05T24:00:00</Time>
  </Modification>
  <Priority>0</Priority>
</ERRDescriptor>
```

EXAMPLE The ER-R is only valid between the 1st and 8th of July 2004. This ER-R has been created on the 30th of June 2004 by CISAC on the Peer 1AC5-4527-A864-3EA2.

NOTE This ER-R should be processed by the Peer in an expedited manner as it is of the highest priority level.

7.4 Event Report Specification

The Event Report Specification provides a set of information about the Event Reports that are created as the result of processing an Event Report Request. It provides a mechanism that allows Event Report Request creators to specify, for example, which data items should be included in the “payload” of the resulting Event Reports and also metadata fields for the Event Reports.

7.4.1 Syntax

```
  <!-- ################################################ -->
  <!-- Definition of ER Descriptor within an ER-R  -->
  <!-- ################################################ -->
  <xsd:element name="ERSpecification">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref="dii:Identifier" minOccurs="0"/>
        <xsd:element name="ERDescription" type="erl:DescriptionType"
minOccurs="0"/>
       <xsd:element name="AccessControl" type="xsd:anyType" minOccurs="0"/>
       <xsd:element name="ERPayloadSpecification">
        <xsd:complexType>
          <xsd:sequence>
           <xsd:element name="ERIdentifier" minOccurs="0">
             <xsd:complexType>
              <xsd:simpleContent>
                <xsd:extension base="xsd:anyURI">
                  <xsd:attribute name="baseId" type="xsd:boolean"/>
                </xsd:extension>
              </xsd:simpleContent>
             </xsd:complexType>
           </xsd:element>
           <xsd:element name="PeerId" minOccurs="0"/>
           <xsd:element name="UserId" minOccurs="0"/>
```

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```
          <xsd:element name="Time" minOccurs="0"/>
          <xsd:element name="Location" minOccurs="0"/>
          <xsd:element name="DIOperation" minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element name="DomainData" minOccurs="0" maxOccurs="unbounded">
            <xsd:complexType>
              <xsd:attribute name="reportTag" type="xsd:string" use="optional"/>
              <xsd:attribute name="semantics" type="xsd:anyURI" use="required"/>
              <xsd:attribute name="syntax" type="xsd:anyURI" use="required"/>
              <xsd:attribute name="value" type="xsd:string" use="optional"/>
            </xsd:complexType>
          </xsd:element>
          <xsd:element name="DIMetadata" minOccurs="0" maxOccurs="unbounded">
            <xsd:complexType>
              <xsd:sequence>
                 <xsd:element name="DISelection" minOccurs="0">
                    <xsd:complexType>
                       <xsd:choice>
                          <xsd:element name="DISelectionViaDII" minOccurs="0"/>
                          <xsd:element name="DISelectionViaRelatedDII"
minOccurs="0"/>
                          <xsd:element name="DISelectionViaXPath"
minOccurs="0"/>
                          <xsd:element name="DISelectionViaMetadataElements"
minOccurs="0" maxOccurs="unbounded">
                             <xsd:complexType>
                                <xsd:attribute name="nameSpace"/>
                                <xsd:attribute name="itemType"/>
                                <xsd:attribute name="itemName"/>
                                <xsd:attribute name="internalOperator"/>
                                <xsd:attribute name="itemValue"/>
                                <xsd:attribute name="externalOperator"/>
                             </xsd:complexType>
                          </xsd:element>
                       </xsd:choice>
                    </xsd:complexType>
                 </xsd:element>
                 <xsd:element name="DIMetadataElement" minOccurs="0"
maxOccurs="unbounded">
                    <xsd:complexType>
                       <xsd:attribute name="nameSpace"/>
                       <xsd:attribute name="tagName"/>
                    </xsd:complexType>
                 </xsd:element>
                 <!-- Selection of the DI from which the metadata will be
reported -->
                 <!-- Selection of the metadata to be reported -->
              </xsd:sequence>
            </xsd:complexType>
          </xsd:element>
        </xsd:sequence>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="ERFormatSpecification">
      <xsd:complexType>
        <xsd:choice>
          <xsd:element name="Ref" type="xsd:anyURI"/>
          <xsd:element name="XMLschema" type="xsd:anyURI"/>
          <xsd:element name="MimeType" type="xsd:string"/>
        </xsd:choice>
      </xsd:complexType>
```


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```
      </xsd:element>
      <xsd:element name="ERDeliverySpecification" minOccurs="0"
maxOccurs="unbounded">
       <xsd:complexType>
        <xsd:sequence>
         <xsd:element name="Recipient" minOccurs="0" maxOccurs="unbounded"
type="erl:RecipientType"/>
         <xsd:element name="DeliveryTime" type="erl:TimeType"/>
         <xsd:element name="DITransportService">
          <xsd:complexType>
           <xsd:sequence>
              <xsd:element ref="r:serviceReference"/>
           </xsd:sequence>
          </xsd:complexType>
         </xsd:element>
        </xsd:sequence>
       </xsd:complexType>
      </xsd:element>
      <xsd:element ref="erl:EmbeddedERR" minOccurs="0" maxOccurs="unbounded"/>
     </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
```

7.4.2 Semantics

Name	Definition
ERSpecification	Describes Event Report(s) that will be created as the result of processing the associated ER-R.
Identifier	Specifies a unique identifier to be used in the ER to be created as a result of an ER-R. This identifier will be in the form of a Digital Item identifier, as specified in ISO/IEC 21000-3.
ERDescription	Free form string field to provide comments on the Event Report.
AccessControl	An REL (ISO/IEC 21000-5) specifying which Peers and/or Users are allowed to access specific parts of the ER. The parts are identified by an Xpath tag.
ERPayloadSpecification	Describes the data that ER-R needs to report. The PeerId, UserId, DII, Related DII, Time and Location are optional sub-elements which can be requested to be sent when a specified Event occurs.
ERIdentifier	Indicates the Identifier that should be used for all ER's that are generated when this ERR is processed.
baseId	The optional baseId attribute is used to indicate that the ERIdentifier specified should be used as the basis for creating an identifier for each ER that results from processing the ER-R. The default behaviour (when this attribute is not supplied) is to use the ERIdentifier as a unique Identifier.
PeerId	Peer in which the Event has occurred.
UserId	User(s) of a Peer in which the Event has occurred.
Time	Time as returned by the Peer in which the Event has occurred.
Location	Geographical location information of the Peer in which the Event has occurred. This element may take values of mpeg7:PlaceType.

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DIOperation	The operation that triggered the Event, if applicable. The DIOperation is a URN pointing to an RDD term as defined by ISO/IEC 21000-6:2004 According to ISO/IEC 21000-6, RDD terms are referred to by a URI and a term identifier as follows: <mpeg:mpeg21ra:RDD:xxx:yyy> Where xxx is the RDD identifier as defined in Annex 5 of ISO/IEC 21000-6:2004 and yyy may be an identifier to be defined by the RDD registration authority. The DIOperation may either be RDD defined operations or be proprietary to the communicating Peer(s). NOTE this exact syntax is not definitive, as it will be specified by the RDD registration authority, not yet operational. (see A.5 of ISO/IEC 21000-6:2004)
DomainData	Encapsulates the definition of domain-specific data that is to be reported within the Event Report.
reportTag	An Optional attribute that defines the tag name that is to be used when reporting the domain-specific reportable data item in the resulting Event Report. When not provided, the default is to use the semantics attribute as the reportable data item element tag.
semantics	Attribute that defines the semantics of the domain-specific data item to be reported.
syntax	Attribute that defines the syntax by which the reportable domain-specific data item is represented.
value	An optional attribute that is used to define a “constant” value which is to be reported in all of the Event Report Request’s Event Reports.
DIMetadata	A element that is used to specify Metadata information from a DI that is to be reported.
DISelection	A complex type that is used to indicate which DI that is to be selected.
DISelectionViaDII	DII that identifies an element which contains the MetadataElementsToBeReported.
DISelectionViaRelatedDII	A related DII that identifies an element which contains the MetadataElementsToBeReported.
DISelectionViaXPath	An XPath statement pointing to a DI onto which the MetadataElementsToBeReported will be applied. The other alternatives for specifying the DI are DISelectionViaDI, DISelectionViaRelatedDII and DISelectionViaMetadataElements
DISelectionViaMetadataElements	A set of Metadata elements that are used to identify the DI from which the MetadataElementsToBeReported will be extracted.
nameSpace	This attribute specifies a namespace within which the related Element is defined.
itemType	This attribute specifies the type of item. The allowed values are either “element” or “attribute”.
itemName	This attribute specifies the name of the item within the nameSpace if specified.
internalOperator	This attribute specifies the operator to be applied to the itemValue as defined in subclause 9.6.
itemValue	This attribute specifies the value of the Item as defined by itemName
externalOperator	This attribute specifies a boolean operator, as defined in subclause 9.5.
DIMetadataElement	The list of metadata elements to be extracted from the DI, as identified by one of the four methods above, and that are to be reported.
tagName	An attribute that defines the name of the element that is to be retrieved.
ERFormatSpecification	Defines the format of the Event Report contained within the ReportData statement.
Ref	A URI reference to a predefined XML Schema to be used for the Event Report.
XMLschema	An embedded XML Schema to be used for the Event Report.

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MimeType	A mime type specifying the format of the Event Report.
ERDeliverySpecification	Defines parameters associated with the ER's recipient(s), delivery time and delivery mechanism(s).
Recipient	Specifies the Peer and/or User that shall receive the Event Report. NOTE that this element is used to specify the User that is intended to receive the Event Report, once it has been delivered to a Peer using the DITransportService.
DeliveryTime	Specifies a time from which the creator of the ER-R expects the generated Event Reports to be delivered. If DeliveryTime is not specified, then the Event Report is to be delivered as soon as possible. If DeliveryTime is in the future in relation to the Peer's current time, then the Event Reports should not yet be delivered.
DITransportService	Describes the preferred transport service to be used by the Peer to deliver the Event Report to the Recipient Peer. This element makes use of the MPEG-21 REL's "ServiceReference" element, which provides a means to make a reference to an external service reference (the interface and also the transport binding) via a WSDL declaration. If no transport service is specified (or if the Peer fails to utilize the specified transport mechanism), then the Peer may (if possible) select an alternate method for delivering the Event Report. If an alternate method is not available, then the behavior is undefined.
EmbeddedERR	This optional element contains an ER-R that shall be processed upon receipt of the Event Report. There may be more than one embedded ER-R that is to be processed. This mechanism can, for example, be used for acknowledgment of receipt or for implementing aggregation / forwarding Event Reports.

7.4.3 Example

```
  <ERSpecification>
    <Identifier xmlns="urn:mpeg:mpeg21:2002:01-DII-
NS">urn:mpegRA:mpeg21:dii:cid:1702</Identifier>
    <ERDescription>This is a description of the ER</ERDescription>
    <AccessControl/>
    <ERPayloadSpecification>
      <ERIdentifier baseId="true">urn:isbn:0-395-36341-1</ERIdentifier>
      <PeerId/>
      <UserId/>
      <Time/>
      <Location/>
      <DIOperation/>
      <DomainData reportTag="Name" semantics="acme:PhoneName"
syntax="xsd:String"/>
      <DomainData semantics="AcmeFilm:length" syntax="xsd:Integer" value="155"/>
      <DIMetadata>
       <DISelection>
        <DISelectionViaDII> urn:mpegra:mpeg21:dii:isrc:BE-R45-98-03948576
        </DISelectionViaDII>
       </DISelection>
       <DIMetadataElement tagName="Title"/>
       <DIMetadataElement tagName="Artist"/>
       <DIMetadataElement tagName="ISWC"/>
      </DIMetadata>
    </ERPayloadSpecification>
```

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```
    <ERFormatSpecification>
      <Ref>http://www.acme.org/schemas/phones.xsd</Ref>
    </ERFormatSpecification>
    <ERDeliverySpecification>
      <Recipient>
       <PeerId>urn:MAC:00-08-E3-AE-1E-62</PeerId>
       <UserId>urn:mpegra:mpeg21:IPI:0012395868374</UserId>
      </Recipient>
      <DeliveryTime>
       <SpecificTime>
        <AfterOn>2005-07-06T00:00:00</AfterOn>
        <BeforeOn>2005-09-06T00:00:00</BeforeOn>
       </SpecificTime>
      </DeliveryTime>
      <DITransportService>
       <r:serviceReference>
        <sx:wsdlComplete>
         <sx:wsdl>
          <nonSecureIndirect URI="http://www.acme.org/ER-wsdlfile.xml"/>
         </sx:wsdl>
         <sx:service>er:SendERService</sx:service>
         <sx:portType>er:SendERPortType</sx:portType>
        </sx:wsdlComplete>
       </r:serviceReference>
      </DITransportService>
    </ERDeliverySpecification>
    <EmbeddedERR>
      <ERRReference>mpeg:mpeg21:dii:ERRID:010</ERRReference>
    </EmbeddedERR>
  </ERSpecification>
```

EXAMPLE Shows the complete description of an Event Report that is generated by processing an ER-R.

7.5 Event Condition Descriptor

An Event occurs when a set of specified conditions are met. This subclause defines how Conditions are expressed. Elements that can be used to define Conditions under which an Event is deemed to have occurred are:

— time-based (specifies a time period in which the Event must occur);

— DI-related operations that have been applied to the specified resource, defined by ISO/IEC 21000-6:2004;

— Peer-related operations (events that are related to the Peer itself rather than an instance of a Digital Item);

— combinations thereof.

Conditions may be defined as the result of a test upon the value of an element. A Boolean operator is available as an "opn" attribute within conditions.

7.5.1 Syntax

```
<!-- ######################################## -->
<!-- Definition of Event Condition Descriptor -->
<!-- ######################################## -->
<xsd:element name="EventConditionDescriptor">
  <xsd:complexType>
```


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```
    <xsd:group ref="erl:EventConditionGroup" maxOccurs="unbounded"/>
  </xsd:complexType>
</xsd:element>

<xsd:group name="EventConditionGroup">
  <xsd:sequence>
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
    <xsd:element name="TimeCondition" minOccurs="0" maxOccurs="unbounded">
      <xsd:complexType>
        <xsd:group ref="erl:TimeConditionGroup" maxOccurs="unbounded"/>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
    <xsd:element name="DIOperationCondition" minOccurs="0" maxOccurs="unbounded">
      <xsd:complexType>
        <xsd:group ref="erl:DIOperationConditionGroup" maxOccurs="unbounded"/>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
    <xsd:element name="PeerCondition" minOccurs="0" maxOccurs="unbounded">
      <xsd:complexType>
        <xsd:group ref="erl:PeerConditionGroup" maxOccurs="unbounded"/>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:group>
<xsd:group name="TimeConditionGroup">
  <xsd:sequence>
    <xsd:element name="TimeEvent" type="erl:TimeType" />
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:group>
<xsd:group name="DIOperationConditionGroup">
  <xsd:sequence>
    <xsd:element name="DIOperationEvent">
      <xsd:complexType>
        <xsd:sequence>
          <xsd:element ref="erl:UserId" minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element ref="erl:PeerId" minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element name="Operation" type="xsd:anyURI"/>
          <xsd:element name="DII" type="xsd:anyURI" maxOccurs="unbounded"/>
          <xsd:element name="RelatedDII" type="xsd:anyURI" minOccurs="0"
maxOccurs="unbounded"/>
        </xsd:sequence>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:group>
<xsd:group name="PeerConditionGroup">
  <xsd:sequence>
    <xsd:element name="PeerEvent">
      <xsd:complexType>
```

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```
      <xsd:sequence>
       <xsd:any namespace="##any" processContents="lax" maxOccurs="unbounded"/>
      </xsd:sequence>
      <xsd:attributeGroup ref="erl:InternalOperator"/>
     </xsd:complexType>
    </xsd:element>
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:group>
```

7.5.2 Semantics

Name	Definition
EventConditionDescriptor	Specifies the Event Conditions. The occurrence of the Event will trigger the creation and delivery of the ER. It contains a TimeCondition, a DIOperationCondition and PeerCondition. At least one Condition shall be specified.
EventConditionGroup	Group for specifying the Event Condition. This is used for the grouping of Event Conditions.
Operator	It is used when the Event occurs by the combinations of TimeCondition and/or DIOperationCondition. It is also used to specify multiple Events within a certain Event Condition. It is of type ExternalOperator is defined in subclause 9.5.
ExternalOperator	Boolean operator as defined in subclause 9.5 to be applied to two or more Events and Conditions.
TimeCondition	Specifies a time-based condition.
TimeConditionGroup	Group for specifying the Time Event Conditions. This is used for the grouping Time Events.
TimeEvent	TimeEvent is of type TimeType as described in subclause 9.2.
DIOperationCondition	Specifies conditions relating to operations on a Digital Item.
DIOperationConditionGroup	Group for specifying the DI Operation Event Conditions. This is used for the grouping the conditions relating DI Operation Events.
UserId	Specifies the User(s) who must be using the Peer when the DI operation occurs. When this field is not provided, the default behaviour is for the DIOperationCondition to apply to any/all Users.
PeerId	Specifies the Peer(s) on which the DI operation must occur. When this field is not provided, the default behaviour is for the DIOperationCondition to apply to any/all Peers.
Operation	Specifies the URN pointing to a RDD term as defined by ISO/IEC 21000-6:2004 According to ISO/IEC 21000-6, RDD terms are referred to by a URI and a term identifier as follows: <mpeg:mpeg21ra:RDD:xxx:yyy>. Where xxx is the RDD identifier as defined in Annex 5 of ISO/IEC 21000-6 and yyy is an identifier to be defined by the RDD registration authority. NOTE this exact syntax is not definitive, as it will be specified by the RDD registration authority, not yet operational. (see A.5 of ISO/IEC 21000-6:2004).
DII	References the DI according to ISO/IEC 21000-3.
RelatedDII	Specifies a DII related to the DII above according to ISO/IEC 21000-3.
PeerCondition	Specifies other event conditions except time-based Condition and DI-related Condition. It enables Users to define new Event Conditions as necessary. This element is used to extend the Event Condition into any other relevant namespace (e.g. DIA, DIP, MPEG-7).
PeerConditionGroup	Group for specifying the Peer Event Conditions. This is used for the grouping Peer Events.

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PeerEvent	Specifies Event Conditions other than time related and DI operation related conditions. It allows an Event Report Request to include Event Conditions based on information not specified by this part of MPEG-21. The information on which the condition is based may be from any other namespace. Erroneous or ambiguous references shall be discarded.
InternalOperator	Comparative operator as defined in subclause 9.6 that applies to two or more PeerEvents.

7.5.3 Examples

```
<EventConditionDescriptor>
  <TimeCondition>
    <TimeEvent>
     <SpecificTime>
       <AfterOn>2005-01-01T00:00:00</AfterOn>
       <BeforeOn>2005-01-31T00:00:00</BeforeOn>
     </SpecificTime>
    </TimeEvent>
    <Operator Name="OR"/>
    <TimeEvent>
     <PeriodicTime>
       <Start>2005-07-06T00:00:00</Start>
       <Period>P2M10D</Period>
       <Duration>P1D</Duration>
       <End>2006-07-06T00:00:00</End>
     </PeriodicTime>
    </TimeEvent>
  </TimeCondition>
  <Operator Name="AND"/>
  <DIOperationCondition>
    <DIOperationEvent>
     <Operation>REL:Play</Operation>
     <DII>mpeg:mpeg21:dii:ID:ACME-010</DII>
    </DIOperationEvent>
  </DIOperationCondition>
  <Operator Name="AND"/>
  <PeerCondition>
    <PeerEvent Name="=" Location="infix">
     <mpeg7:Region>au</mpeg7:Region>
    </PeerEvent>
    <Operator Name="OR"/>
    <PeerEvent Name="=" Location="infix">
     <mpeg7:Region>kr</mpeg7:Region>
    </PeerEvent>
  </PeerCondition>
</EventConditionDescriptor>
```

EXAMPLE This example shows a combination of two time-based Events, a DIOperation-related Event and two PeerEvents. Each of these is combined into a single Boolean expression through the use of Operator elements.

8 Event Reports

8.1 Introduction

As indicated previously, the basic model of Event Reporting indicates that Events that need to be reported (as specified by an ER-R) are represented as an Event Report (ER). The ER's purpose is to:

- indicate which Peer created the ER,

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- define the data items that are to be included in such an Event Report(s),
- provide a reference to the originating ER-R,
- provide status information regarding its completion and creation, along with a free-form description.

When an Event Report is packaged within a Digital Item, the identity and access control specification of an ER is given through the use of two elements that need to be inserted at the top level of the *item* which contains an Event Report, before the Event Report Descriptor. These two elements are:

-Event Report identifier (as specified in subclause 6.3.1),
-Event Report access control information (as specified in subclause 6.3.2).

The following subclauses provide details on the syntax and semantics of ERs.

8.2 High-level Structure

Event Reports contain three main Elements. They are used to provide description of the Event Report, to contain the Event Report's payload and to optionally contain an Embedded Event Report Request. These three Elements are described in more detail in the following subclauses.

8.2.1 Syntax

```
<!-- ######################################## -->
<!--       Definition of ER                   -->
<!-- ######################################## -->

<xsd:element name="ER">
<xsd:complexType>
  <xsd:sequence>
    <xsd:element ref="erl:ERDescriptor"/>
    <xsd:element ref="erl:ERData"/>
    <xsd:element ref="erl:EmbeddedERR" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
</xsd:complexType>
```

8.2.2 Semantics

Name	Definition
ER	Serves as the root element for describing an entire Event Report.
ERDescriptor	This section describes the Event Report. It contains: Description – free-form string field. Status – Provides information on whether the Peer was able to compliantly generate the Event Report. Creation – provides information regarding the creation of the Event Report.
ERData	Contains the "payload" data of the Event Report.
EmbeddedERR	An Event Report Request that that has been included within is associated with an Event Report.

8.2.3 Example

An example of a full Event Report is provided in Annex C.

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8.3 Event Report Descriptor

Event Reports are always identified by a Digital Item Identifier as specified in ISO/IEC 21000-3. The identification of an ER is ensured by the fact that the *descriptor* element (as defined in ISO/IEC 21000-2) containing the ER is uniquely identified by a Digital Item Identifier.

8.3.1 Syntax

```
<!-- ######################################## -->
<!--   Definition of Event Report Descriptor  -->
<!-- ######################################## -->

<xsd:element name="ERDescriptor">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="Description" type="erl:DescriptionType" minOccurs="0"/>
      <xsd:element name="Recipient" type="erl:RecipientType"/>
      <xsd:element name="Status">
        <xsd:complexType>
          <xsd:attribute name="value" type="xsd:boolean" default="false"/>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="Modification" type="erl:ModificationType" minOccurs="1"
maxOccurs="unbounded"/>
      <xsd:element name="ERSource" maxOccurs="1">
        <xsd:complexType>
          <xsd:choice minOccurs="1">
            <xsd:element ref="erl:ERR" minOccurs="0"/>
            <xsd:element name="ERRReference" type="xsd:anyURI" minOccurs="0"/>
            <xsd:element name="OtherSource" type="xsd:anyURI" minOccurs="0"/>
          </xsd:choice>
        </xsd:complexType>
      </xsd:element>    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

8.3.2 Semantics

Name	Definition
ERDescriptor	Describes an Event Report.
Description	Free form string field to provide comments on the Event Report
Status	Represents the completion status of the ER.
value	The value is TRUE if the ER has been properly generated in compliance with the original ER-R. If an error is detected during creation of the ER, this flag will be set to FALSE. Note that further error handling is application specific and not normative.
Modification	Maintains the history of modifications or the ER. This field shall be used at least once to hold the information pertaining to the creation of the ER. In the ER, the first occurrence of this element will always describe the creation of the ER.
PeerId	The identifier of the Peer that created or modified the Event Report. May be defined within a namespace.
UserId	The identifier of the User that created or modified the Event Report.
Time	Specifies the date and time at which the ER was created or modified.

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Description	Free form field to provide additional information.
Recipient	Contains the identity of the User or Peer which is the intended recipient of the Event Report.
ERSource	Pertains to the original source that created the ER. It is either specified as a reference to the ER-R or actually embeds the ER-R. Either an ER-R or a source application can be used to generate ERs. This allows the Recipient to cross-check the validity of the ER.
ERR	An inline ER-R that was the source of this Event Report.
ERRReference	A reference to the ER-R that was the source of this Event Report.
OtherSource	A unique reference to an application that is the source of the Event Report.

8.3.3 Example

```
<ERDescriptor>
  <Description>
    This is the ER which MPEG wanted to be reported when the specified ER-R was
processed.
  </Description>

  <Status value="TRUE"/>

  <Modification>
    <PeerId>GUID:1AC5-4527-A864-3EA2</PeerId>
    <Time>2004-07-03T24:00:00</Time>
    <Description>ER created by Joe Doe Junior</Description>
  </Modification>

  <ERSource>
    <ERRReference>
      mpeg:mpeg21:dii:ERRID:002
    </ERRReference>
  </ERSource>
</ERDescriptor>
```

EXAMPLE This example shows the ERDescriptor element of an ER. The value of the Status flag indicates that the ER has been processed as intended by the creator of the ER-R.

8.4 Event Report Data

This Event Report Data element within an Event Report provides a place for inclusion of “payload” data into an ER. This payload data corresponds to the report data items that were specified in the associated ER-R (see subclause 7.1.3), which are formatted according to the format specification also included in the originating ER-R (see subclause 7.1.3).

8.4.1 Syntax

```
<!-- ############################################ -->
<!--   Definition of ERData                       -->
<!-- ############################################ -->

<xsd:element name="ERData">
  <xsd:complexType>
    <xsd:sequence>
```


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```
      <xsd:element ref="erl:PeerId" minOccurs="0"/>
      <xsd:element ref="erl:UserId" minOccurs="0"/>
      <xsd:element name="Time" type="xsd:dateTime" minOccurs="0"/>
      <xsd:element name="Location" type="mpeg7:PlaceType" minOccurs="0"/>
      <xsd:element name="DII" type="xsd:anyURI" minOccurs="0">
      <xsd:element name="RelatedDII" type="xsd:anyURI" minOccurs="0">
      <xsd:element name="DIOperation" type="xsd:anyURI" minOccurs="0">
      <xsd:element name="ReportedDomainData" minOccurs="0" maxOccurs="unbounded">
        <xsd:complexType>
          <xsd:sequence>
            <xsd:any namespace="##any" processContents="lax"
maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attribute name="semantics" type="xsd:string"/>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="ReportedDIMetadata" minOccurs="0" maxOccurs="unbounded">
        <xsd:complexType>
          <xsd:sequence>
            <xsd:any namespace="##any" processContents="lax"
maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attribute name="name" type="xsd:string"/>
        </xsd:complexType>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

8.4.2 Semantics

Name	Definition
ERData	Embeds data that the Peer reports.
PeerId	URI of the Peer that has created the ER.
UserId	URI of the User that was using the Peer that created the ER.
Time	Time as returned by the Peer.
Location	Location information of Peer.
DII	Referenced DII
RelatedDII	Related DII
DIOperation	Specifies the URN pointing to an RDD term as defined by ISO/IEC 21000-6. According to ISO/IEC 21000-6, RDD terms are referred to by a URI and a term identifier as follows: <mpeg:mpeg21ra:RDD:xxx:yyy> Where xxx is the RDD identifier as defined in Annex 5 of ISO/IEC 21000-6:2004 and yyy is an identifier to be defined by the RDD registration authority. NOTE this exact syntax is not definitive, as it will be specified by the RDD registration authority, not yet operational. (see A.5 of ISO/IEC 21000-6:2004).
ReportedDomainData	This element acts as a wrapper that holds domain-specific data item elements that are to be included within the ER.
semantics	The semantics attribute is the specific semantics from the ER-R that indicates the "meaning" of the ReportedDomainData being reported. The semantics attribute may be prefixed by a namespace.

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ReportedDIMetadata	Refers to meta-data items associated with the DI (resources) that is being operated on - such as Title, Author, ISBC, Publication Date, Genre etc.
name	Name is the specific name of the field to being reported. Name may be prefixed by a namespace.

8.4.3 Example

```
<ERData>
  <PeerId>IP:192.168.1.21<PeerId>
  <DIOperation>urn:mpeg:mpeg21ra:RDD:156:735</DIOperation>
  <Time>2004-07-01T00:00:00</Time>
  <DII>dii:mpeg:mpeg21:ERDID:002</DII>
  <ReportedDomainData>
    <dia:Network>
     <NetworkCharacteristic xsi:type="NetworkCapabilityType" maxCapacity="384000"
minGuaranteed="32000"/>
     <NetworkCharacteristic xsi:type="NetworkConditionType"
duration="PT330N1000F">
      <AvailableBandwidth maximum="256000" average="80000"/>
      <Delay packetTwoWay="330" delayVariation="66"/>
      <Error packetLossRate="0.05"/>
      </NetworkCharacteristic>
    </dia:Network>
  </ReportedDomainData>
  <ReportedDomainData>
      <Name semantics="acme:PhoneName">AcmeModel231-ANS</Name>
  </ReportedDomainData>
  <ReportedDIMetadata>
      <Title>A very catchy Tune</Title>
      <Artist>The hippest guys on the Block</Artist>
      <ISWC>T-345246800-1</ISWC>
  </ReportedDIMetadata>
</ERData>
```

8.5 Embedded Event Report Requests

The embedding of an ER-R within an ER can be used for functionalities such as acknowledgment of receipt or forwarding of the Event Report to another Peer. The Embedded ER-R may either be inline, or a reference to an external ER-R.

8.5.1 Syntax

```
<!-- ################################################ -->
<!--    Definition of Embedded Event Report Request    -->
<!-- ################################################ -->

<xsd:element name="EmbeddedERR">
  <xsd:complexType>
    <xsd:choice maxOccurs="unbounded">
      <xsd:element ref="erl:ERR"/>
      <xsd:element name="ERRReference" type="xsd:anyURI"/>
    </xsd:choice>
  </xsd:complexType>
</xsd:element>
```


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8.5.2 Semantics

Name	Definition
EmbeddedERR	This element contains and ER-R that shall be processed upon reception of the ER. This mechanism can, for example, be used for acknowledgment of receipt or for implementing aggregation / forwarding Event Reports. There may be more that one embedded ER-R that needs to be processed.
ERRReference	Provides a URI reference to the embedded ER-R.

8.5.3 Example

```
<EmbeddedERR>
 <ERR>
  <erl:ERRDescriptor/>
  <erl:ERDescriptor/>
  <erl:EventConditionDescriptor/>
 </ERR>
</EmbeddedERR>
```

Example: An ER-R, fully embedded within the ER.

```
<EmbeddedERR>
 <ERRReference>ID:mepeg:mpeg21:DII:ERRDID:002</ERRReference>
</EmbeddedERR>
```

Example: An ER-R, only referenced within the ER.

9 Data Types

9.1 Introduction

This specification makes use of a number of re-usable DataTypes that have been referenced in preceding clauses. The syntax and semantics of these Types is given in subsequent subclauses.

9.2 TimeType

9.2.1 Syntax

```
<xsd:complexType name="TimeType">
  <xsd:choice minOccurs="0">
    <xsd:element name="SpecificTime" type="erl:SpecificTimeType"/>
    <xsd:element name="ElapsedTime" type="erl:ElapsedTimeType"/>
    <xsd:element name="PeriodicTime" type="erl:PeriodicTimeType"/>
  </xsd:choice>
</xsd:complexType>

<xsd:complexType name="SpecificTimeType">
  <xsd:choice>
    <xsd:element name="OnTime" type="xsd:dateTime"/>
    <xsd:sequence>
      <xsd:element name="AfterOn" type="xsd:dateTime" minOccurs="0"/>
      <xsd:element name="BeforeOn" type="xsd:dateTime" minOccurs="0"/>
```

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```
    </xsd:sequence>
  </xsd:choice>
</xsd:complexType>

<xsd:complexType name="ElapsedTimeType">
  <xsd:sequence>
    <xsd:element name="StartElapse" type="erl:StartElapseType" minOccurs="0"/>
    <xsd:element name="EndElapse" type="erl:EndElapseType" minOccurs="0"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:complexType name="StartElapseType">
  <xsd:choice>
    <xsd:element name="sTime" type="xsd:time"/>
    <xsd:element name="sDuration" type="xsd:duration"/>
  </xsd:choice>
</xsd:complexType>

<xsd:complexType name="EndElapseType">
  <xsd:choice>
    <xsd:element name="eTime" type="xsd:time"/>
    <xsd:element name="eDuration" type="xsd:duration"/>
  </xsd:choice>
</xsd:complexType>

<xsd:complexType name="PeriodicTimeType">
    <xsd:sequence>
      <xsd:element name="Start" type="xsd:dateTime"/>
      <xsd:element name="DayofWeek" type="erl:DayofWeekType" minOccurs="0"/>
      <xsd:element name="Period" type="xsd:duration"/>
      <xsd:element name="Duration" type="xsd:duration"/>
      <xsd:element name="End" type="xsd:dateTime"/>
    </xsd:sequence>
</xsd:complexType>

<!-- Definition of DayofWeekType datatype -->
<xsd:simpleType name="DayofWeekType">
  <xsd:restriction base="xsd:string">
    <xsd:pattern value="\-?[1-5]{1}W[1-7]{1}D" />
  </xsd:restriction>
</xsd:simpleType>
```

9.2.2 Semantics

Name	Definition
TimeType	Time structure for ISO/IEC 21000 Event Reporting
SpecificTimeType	A specific time that is composed of onTime, afterOn and beforeOn
ElapsedTimeType	Duration time interval for a certain base such as an Event. Composed of beginElapse and endElapse.
PeriodicTimeType	Represents time that recurs periodically. Composed of Start, DayofWeek, Period, Duration and End.
OnTime	Represents a specific time instinct.
AfterOn	After a specific time
BeforeOn	Before a specific time

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StartElapseType	Indicates the beginning time of; if absent, the delivery is considered to begin when an event occurs.
EndElapseType	Indicates the end time of duration
sTime	Indicates that elapsed time starts from the specific time of the day; for example, the midnight of the day event occurs.
sDuration	Indicates that that elapsed time starts from some elapsed duration after a certain base; for example, from 2 hours after an Event
eTime	Indicates that elapsed time ends by the specific time of the day.
eDuration	Indicates that that elapsed time ends by some elapsed duration after a certain base
Start	Indicates the start of the periodic time.
End	Indicates the end of the periodic time.
DayofWeek	Describes the day of a certain week. It has the format *n*W*m*D, where *n*W represents the number of weeks, *m*D the day of week. For example "2W1D" means Monday of 2nd week. An optional preceding minus sign ('-') is allowed, to indicate a negative representation. For example, "-1W2D" means Tuesday of last week".
Period	Indicates the interval of periodic time.
Duration	Describes the period of time during which the Event Reporting is to be performed. Note that this is related to the Period element as the Duration is the amount of periodically repeating time.

9.3 PeerId Type

9.3.1 Syntax

```
<!-- Definition of PeerId -->

<xsd:element name="PeerId" type="xsd:anyURI"/>
```

9.3.2 Semantics

Name	Definition
PeerId	The identifier of a Peer.

9.4 UserId Type

9.4.1 Syntax

```
<!-- Definition of UserId -->

<xsd:element name="UserId" type="xsd:anyURI"/>
```

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9.4.2 Semantics

Name	Definition
UserId	The identifier of a User in Event Reporting.

9.5 ExternalOperator

9.5.1 Syntax

```
<xsd:complexType name="ExternalOperator">
  <xsd:attribute name="name" type="erl:ExternalOprType"/>
</xsd:complexType>

<xsd:simpleType name="ExternalOprType">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="AND"/>
    <xsd:enumeration value="OR"/>
    <xsd:enumeration value="XOR"/>
    <xsd:enumeration value="NOT"/>
    <xsd:enumeration value="("/>
    <xsd:enumeration value=")"/>
  </xsd:restriction>
</xsd:simpleType>
```

9.5.2 Semantics

Name	Definition
ExternalOperator	Specifies the operators among the Event conditions.
name	An attribute that specifies the operator to be used. Includes logical operators and also parenthesis operators.
ExternalOprType	Specifies the operators which Name can have.

9.6 InternalOperator

9.6.1 Syntax

```
<xsd:attributeGroup name="InternalOperator">
  <xsd:attribute name="name" type="erl:InternalOprType"/>
  <xsd:attribute name="location" type="erl:InternalOprLocationType"/>
</xsd:attributeGroup>

<xsd:simpleType name="InternalOprType">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="&gt;"/>
    <xsd:enumeration value="&lt;"/>
    <xsd:enumeration value="&gt;="/>
    <xsd:enumeration value="&lt;="/>
    <xsd:enumeration value="&gt;&lt;"/>
    <xsd:enumeration value="="/>
    <xsd:enumeration value="+"/>
```


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```
    <xsd:enumeration value="-"/>
    <xsd:enumeration value="*"/>
    <xsd:enumeration value="/"/>
    <xsd:enumeration value="%"/>
    <xsd:enumeration value="("/>
    <xsd:enumeration value=")"/>
  </xsd:restriction>
</xsd:simpleType>

<xsd:simpleType name="InternalOprLocationType">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="prefix"/>
    <xsd:enumeration value="infix"/>
    <xsd:enumeration value="postfix"/>
  </xsd:restriction>
</xsd:simpleType>
```

9.6.2 Semantics

Name	Definition
InternalOperator	Specifies the operator used for PeerEvent to express the Peer's status such as, for example, NetworkCongestion >= 0.8
name	An attribute that specifies the internal operator of Peer Event. Includes the arithmetic operators and comparison operators.
location	An attribute that specifies the location of operator. It consists of prefix, infix and postfix. The prefix takes precedence over postfix based on condition.

9.7 DescriptionType

9.7.1 Syntax

```
<!-- Definition of DescriptionType -->

<xsd:simpleType name="DescriptionType">
  <xsd:restriction base="xsd:string"/>
</xsd:simpleType>
```

9.7.2 Semantics

Name	Definition
DescriptionType	Used as the type for a free-form string description.

9.8 ModificationType

9.8.1 Syntax

```
<!-- Definition of ModificationType -->

<xsd:complexType name="ModificationType">
```

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```
  <xsd:sequence>
    <xsd:element ref="erl:PeerId"/>
    <xsd:element ref="erl:UserId"/>
    <xsd:element name="Time" type="xsd:dateTime"/>
    <xsd:element name="Description" type="erl:DescriptionType" minOccurs="0"/>
  </xsd:sequence>
</xsd:complexType>
```

9.8.2 Semantics

Name	Definition
ModificationType	Used to describe the details of a Creation and/or Modification action.
PeerId	Identification of the Peer who has made created or modified the ER-R
UserId	Identification of the User who has made created or modified the ER-R
Time	Date and Time at which the ER-R was either created of modified
Description	Free field form to describe the creation or the modification.

9.9 RecipientType

9.9.1 Syntax

```
<!-- Definition of RecipientType -->

<xsd:complexType name="RecipientType">
  <xsd:sequence>
    <xsd:element ref="erl:PeerId"/>
    <xsd:element ref="erl:UserId"/>
  </xsd:sequence>
</xsd:complexType>
```

9.9.2 Semantics

Name	Definition
RecipientType	Used to describe the details of a Creation and/or Modification action.
PeerId	Identification of the Peer who has made created or modified the ER-R
UserId	Identification of the User who has made created or modified the ER-R

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Annex A
(informative)

XML Schema Definition

```
<?xml version="1.0"?>
<!--================================================================-->
<!--================================================================-->
<!--                                                                -->
<!--           Schema for ERL XML Document Type                     -->
<!--                                                                -->
<!--================================================================-->
<!--================================================================-->
<xsd:schema targetNamespace="urn:mpeg:mpeg21:2005:01-ERL-NS"
xmlns:erl="urn:mpeg:mpeg21:2005:01-ERL-NS"
xmlns:dsig="http://www.w3.org/2000/09/xmldsig#" xmlns:r="urn:mpeg:mpeg21:2003:01-
REL-R-NS" xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS"
xmlns:dia="urn:mpeg:mpeg21:2003:01-DIA-NS"
xmlns:sx="urn:mpeg:mpeg21:2003:01-REL-SX-NS"
xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
attributeFormDefault="unqualified">
  <xsd:import namespace="urn:mpeg:mpeg21:2003:01-DIA-NS"
schemaLocation="dia.xsd"/>
  <xsd:import namespace="urn:mpeg:mpeg21:2002:01-DII-NS"
schemaLocation="dii.xsd"/>
  <xsd:import namespace="urn:mpeg:mpeg21:2003:01-REL-R-NS" schemaLocation="rel-
r.xsd"/>
  <xsd:import namespace="urn:mpeg:mpeg21:2003:01-REL-SX-NS" schemaLocation="rel-
sx.xsd"/>
  <xsd:import namespace="urn:mpeg:mpeg7:schema:2004" schemaLocation="mpeg7.xsd"/>
  <xsd:import namespace="http://www.w3.org/XML/1998/namespace"
schemaLocation="./xml_2001.xsd"/>
  <!-- ########################################### -->
  <!--  7.1 Definition of an Event Report Request   -->
  <!-- ########################################### -->
  <xsd:element name="ERR">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref="erl:ERRDescriptor"/>
        <xsd:element ref="erl:ERSpecification"/>
        <xsd:element ref="erl:EventConditionDescriptor"/>
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
  <!-- ######################################### -->
  <!-- 7.2 Definition of ERRDescriptor          -->
  <!-- ######################################### -->
  <xsd:element name="ERRDescriptor">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element name="LifeTime" minOccurs="0">
          <xsd:complexType>
            <xsd:sequence>
              <xsd:element name="StartTime" type="xsd:dateTime"/>
              <xsd:element name="EndTime" type="xsd:dateTime"/>
```

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```
          </xsd:sequence>
        </xsd:complexType>
       </xsd:element>
       <xsd:element name="Modification" type="erl:ModificationType"
maxOccurs="unbounded"/>
       <xsd:element name="Priority" default="2" minOccurs="0">
        <xsd:simpleType>
         <xsd:restriction base="xsd:string">
          <xsd:enumeration value="0"/>
          <xsd:enumeration value="1"/>
          <xsd:enumeration value="2"/>
          <xsd:enumeration value="3"/>
          <xsd:enumeration value="4"/>
          <xsd:enumeration value="5"/>
         </xsd:restriction>
        </xsd:simpleType>
       </xsd:element>
     </xsd:sequence>
   </xsd:complexType>
  </xsd:element>
  <xsd:complexType name="ModificationType">
   <xsd:sequence>
    <xsd:element ref="erl:PeerId"/>
    <xsd:element ref="erl:UserId"/>
    <xsd:element name="Time" type="xsd:dateTime"/>
    <xsd:element name="Description" type="erl:DescriptionType" minOccurs="0"/>
   </xsd:sequence>
  </xsd:complexType>
  <!-- ################################################ -->
  <!-- 7.3 Definition of ER Descriptor within an ER-R  -->
  <!-- ################################################ -->
  <xsd:element name="ERSpecification">
   <xsd:complexType>
    <xsd:sequence>
     <xsd:element ref="dii:Identifier" minOccurs="0"/>
     <xsd:element name="ERDescription" type="erl:DescriptionType"
minOccurs="0"/>
       <xsd:element name="AccessControl" type="xsd:anyType" minOccurs="0"/>
       <xsd:element name="ERPayloadSpecification">
        <xsd:complexType>
         <xsd:sequence>
          <xsd:element name="ERIdentifier" minOccurs="0">
           <xsd:complexType>
            <xsd:simpleContent>
               <xsd:extension base="xsd:anyURI">
                  <xsd:attribute name="baseId" type="xsd:boolean"/>
               </xsd:extension>
            </xsd:simpleContent>
           </xsd:complexType>
          </xsd:element>
          <xsd:element name="PeerId" minOccurs="0"/>
          <xsd:element name="UserId" minOccurs="0"/>
          <xsd:element name="Time" minOccurs="0"/>
          <xsd:element name="Location" minOccurs="0"/>
          <xsd:element name="DIOperation" minOccurs="0" maxOccurs="unbounded"/>
          <xsd:element name="DomainData" minOccurs="0" maxOccurs="unbounded">
           <xsd:complexType>
            <xsd:attribute name="reportTag" type="xsd:string" use="optional"/>
            <xsd:attribute name="semantics" type="xsd:anyURI" use="required"/>
            <xsd:attribute name="syntax" type="xsd:anyURI" use="required"/>
```

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```
              <xsd:attribute name="value" type="xsd:string" use="optional"/>
            </xsd:complexType>
          </xsd:element>
          <xsd:element name="DIMetadata" minOccurs="0" maxOccurs="unbounded">
            <xsd:complexType>
             <xsd:sequence>
                <xsd:element name="DISelection" minOccurs="0">
                   <xsd:complexType>
                      <xsd:choice>
                         <xsd:element name="DISelectionViaDII" minOccurs="0"/>
                         <xsd:element name="DISelectionViaRelatedDII"
minOccurs="0"/>
                         <xsd:element name="DISelectionViaXPath"
minOccurs="0"/>
                         <xsd:element name="DISelectionViaMetadataElements"
minOccurs="0" maxOccurs="unbounded">
                            <xsd:complexType>
                               <xsd:attribute name="nameSpace"/>
                               <xsd:attribute name="itemType"/>
                               <xsd:attribute name="itemName"/>
                               <xsd:attribute name="internalOperator"/>
                               <xsd:attribute name="itemValue"/>
                               <xsd:attribute name="externalOperator"/>
                            </xsd:complexType>
                         </xsd:element>
                      </xsd:choice>
                   </xsd:complexType>
                </xsd:element>
                <xsd:element name="DIMetadataElement" minOccurs="0"
maxOccurs="unbounded">
                   <xsd:complexType>
                      <xsd:attribute name="nameSpace"/>
                      <xsd:attribute name="tagName"/>
                   </xsd:complexType>
                </xsd:element>
                <!-- Selection of the DI from which the metadata will be
reported -->
                <!-- Selection of the metadata to be reported -->
             </xsd:sequence>
            </xsd:complexType>
          </xsd:element>
        </xsd:sequence>
       </xsd:complexType>
      </xsd:element>
      <xsd:element name="ERFormatSpecification">
       <xsd:complexType>
        <xsd:choice>
         <xsd:element name="Ref" type="xsd:anyURI"/>
         <xsd:element name="XMLschema" type="xsd:anyURI"/>
         <xsd:element name="MimeType" type="xsd:string"/>
        </xsd:choice>
       </xsd:complexType>
      </xsd:element>
      <xsd:element name="ERDeliverySpecification" minOccurs="0"
maxOccurs="unbounded">
       <xsd:complexType>
        <xsd:sequence>
         <xsd:element name="Recipient" minOccurs="0" maxOccurs="unbounded"
type="erl:RecipientType"/>
          <xsd:element name="DeliveryTime" type="erl:TimeType"/>
```

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```
            <xsd:element name="DITransportService">
             <xsd:complexType>
              <xsd:sequence>
               <xsd:element ref="r:serviceReference"/>
              </xsd:sequence>
             </xsd:complexType>
            </xsd:element
          </xsd:sequence>
        </xsd:complexType>
       </xsd:element>
       <xsd:element ref="erl:EmbeddedERR" minOccurs="0" maxOccurs="unbounded"/>
     </xsd:sequence>
   </xsd:complexType>
  </xsd:element>
  <!-- ########################################### -->
  <!-- 7.4 Definition of Event Condition Descriptor -->
  <!-- ########################################### -->
  <xsd:element name="EventConditionDescriptor">
   <xsd:complexType>
    <xsd:group ref="erl:EventConditionGroup" maxOccurs="unbounded"/>
   </xsd:complexType>
  </xsd:element>

  <xsd:group name="EventConditionGroup">
   <xsd:sequence>
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
    <xsd:element name="TimeCondition" minOccurs="0" maxOccurs="unbounded">
      <xsd:complexType>
       <xsd:group ref="erl:TimeConditionGroup" maxOccurs="unbounded"/>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
    <xsd:element name="DIOperationCondition" minOccurs="0"
maxOccurs="unbounded">
      <xsd:complexType>
       <xsd:group ref="erl:DIOperationConditionGroup" maxOccurs="unbounded"/>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
    <xsd:element name="PeerCondition" minOccurs="0" maxOccurs="unbounded">
      <xsd:complexType>
       <xsd:group ref="erl:PeerConditionGroup" maxOccurs="unbounded"/>
      </xsd:complexType>
    </xsd:element>
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
   </xsd:sequence>
  </xsd:group>

  <xsd:group name="TimeConditionGroup">
   <xsd:sequence>
    <xsd:element name="TimeEvent" type="erl:TimeType" />
    <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
   </xsd:sequence>
  </xsd:group>
```


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```
  <xsd:group name="DIOperationConditionGroup">
    <xsd:sequence>
      <xsd:element name="DIOperationEvent">
        <xsd:complexType>
         <xsd:sequence>
           <xsd:element ref="erl:UserId" minOccurs="0" maxOccurs="unbounded"/>
           <xsd:element ref="erl:PeerId" minOccurs="0" maxOccurs="unbounded"/>
           <xsd:element name="Operation" type="xsd:anyURI"/>
           <xsd:element name="DII" type="xsd:anyURI" maxOccurs="unbounded"/>
           <xsd:element name="RelatedDII" type="xsd:anyURI" minOccurs="0"
maxOccurs="unbounded"/>
         </xsd:sequence>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:group>

  <xsd:group name="PeerConditionGroup">
    <xsd:sequence>
      <xsd:element name="PeerEvent">
        <xsd:complexType>
         <xsd:sequence>
           <xsd:any namespace="##any" processContents="lax"
maxOccurs="unbounded"/>
         </xsd:sequence>
         <xsd:attributeGroup ref="erl:InternalOperator"/>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="Operator" type="erl:ExternalOperator" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:group>
  <!-- ############################################ -->
  <!-- 8.1 Definition of ER                        -->
  <!-- ############################################ -->
  <xsd:element name="ER">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref="erl:ERDescriptor"/>
        <xsd:element ref="erl:ERData"/>
        <xsd:element ref="erl:EmbeddedERR" minOccurs="0" maxOccurs="unbounded"/>
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
  <!-- ########################################### -->
  <!-- 8.2 Definition of Event Report Descriptor  -->
  <!-- ########################################### -->
  <xsd:element name="ERDescriptor">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element name="Description" type="erl:DescriptionType" minOccurs="0"/>
        <xsd:element name="Recipient" type="erl:RecipientType"/>
        <xsd:element name="Status">
         <xsd:complexType>
           <xsd:attribute name="value" type="xsd:boolean" default="false"/>
         </xsd:complexType>
        </xsd:element>
```

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```
      <xsd:element name="Modification" type="erl:ModificationType"
maxOccurs="unbounded"/>
      <xsd:element name="ERSource">
       <xsd:complexType>
        <xsd:choice>
         <xsd:element ref="erl:ERR" minOccurs="0"/>
         <xsd:element name="ERRReference" type="xsd:anyURI" minOccurs="0"/>
         <xsd:element name="OtherSource" type="xsd:anyURI" minOccurs="0"/>
        </xsd:choice>
       </xsd:complexType>
      </xsd:element>
     </xsd:sequence>
   </xsd:complexType>
  </xsd:element>
  <!-- ########################################### -->
  <!-- 8.3 Definition of ERData                    -->
  <!-- ########################################### -->
  <xsd:element name="ERData">
   <xsd:complexType>
    <xsd:sequence>
      <xsd:element ref="erl:PeerId" minOccurs="0"/>
      <xsd:element ref="erl:UserId" minOccurs="0"/>
      <xsd:element name="Time" type="xsd:dateTime" minOccurs="0"/>
      <xsd:element name="Location" type="mpeg7:PlaceType" minOccurs="0"/>
      <xsd:element name="DII" type="xsd:anyURI" minOccurs="0"/>
      <xsd:element name="RelatedDII" type="xsd:anyURI" minOccurs="0"/>
      <xsd:element name="DIOperation" type="xsd:anyURI" minOccurs="0"/>
      <xsd:element name="ReportedDomainData" minOccurs="0"
maxOccurs="unbounded">
       <xsd:complexType>
        <xsd:sequence>
         <xsd:any namespace="##any" processContents="lax"
maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:attribute name="name" type="xsd:string"/>
       </xsd:complexType>
      </xsd:element>
      <xsd:element name="ReportedDIMetadata" minOccurs="0"
maxOccurs="unbounded">
       <xsd:complexType>
        <xsd:sequence>
         <xsd:any namespace="##any" processContents="lax"
maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:attribute name="name" type="xsd:string"/>
       </xsd:complexType>
      </xsd:element>
     </xsd:sequence>
   </xsd:complexType>
  </xsd:element>
  <!-- ############################################### -->
  <!-- 8.4 Definition of Embedded Event Report Request -->
  <!-- ############################################### -->
  <xsd:element name="EmbeddedERR">
   <xsd:complexType>
    <xsd:choice maxOccurs="unbounded">
      <xsd:element ref="erl:ERR"/>
      <xsd:element name="ERRReference" type="xsd:anyURI"/>
    </xsd:choice>
   </xsd:complexType>
```

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```
  </xsd:element>
  <!-- ########################################### -->
  <!-- 9.1 Definition of Time types                -->
  <!-- ########################################### -->
  <xsd:complexType name="TimeType">
    <xsd:choice minOccurs="0">
      <xsd:element name="SpecificTime" type="erl:SpecificTime"/>
      <xsd:element name="ElapsedTime" type="erl:ElapsedTime"/>
      <xsd:element name="PeriodicTime" type="erl:PeriodicTime"/>
    </xsd:choice>
  </xsd:complexType>
  <xsd:complexType name="SpecificTime">
    <xsd:choice>
      <xsd:element name="OnTime" type="xsd:dateTime"/>
      <xsd:sequence>
        <xsd:element name="AfterOn" type="xsd:dateTime" minOccurs="0"/>
        <xsd:element name="BeforeOn" type="xsd:dateTime" minOccurs="0"/>
      </xsd:sequence>
    </xsd:choice>
  </xsd:complexType>
  <xsd:complexType name="ElapsedTime">
    <xsd:sequence>
      <xsd:element name="StartElapse" type="erl:StartElapse" minOccurs="0"/>
      <xsd:element name="EndElapse" type="erl:EndElapse" minOccurs="0"/>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="StartElapse">
    <xsd:choice>
      <xsd:element name="sTime" type="xsd:time"/>
      <xsd:element name="sDuration" type="xsd:duration"/>
    </xsd:choice>
  </xsd:complexType>
  <xsd:complexType name="EndElapse">
    <xsd:choice>
      <xsd:element name="eTime" type="xsd:time"/>
      <xsd:element name="eDuration" type="xsd:duration"/>
    </xsd:choice>
  </xsd:complexType>
  <xsd:complexType name="PeriodicTime">
    <xsd:sequence>
      <xsd:element name="Start" type="xsd:dateTime"/>
      <xsd:element name="DayofWeek" type="erl:DayofWeekType" minOccurs="0"/>
      <xsd:element name="Period" type="xsd:duration"/>
      <xsd:element name="Duration" type="xsd:duration"/>
      <xsd:element name="End" type="xsd:dateTime"/>
    </xsd:sequence>
  </xsd:complexType>
  <!-- Definition of DayofWeekType datatype -->
  <xsd:simpleType name="DayofWeekType">
    <xsd:restriction base="xsd:string">
      <xsd:pattern value="\-?[1-5]{1}W[1-7]{1}D"/>
    </xsd:restriction>
  </xsd:simpleType>
  <!-- ########################################### -->
  <!-- 9.2 Definition of PeerId                    -->
  <!-- ########################################### -->
  <xsd:element name="PeerId" type="xsd:anyURI"/>
  <!-- ########################################### -->
  <!-- 9.3 Definition of UserId                    -->
  <!-- ########################################### -->
```

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```
  <xsd:element name="UserId" type="xsd:anyURI"/>
  <!-- ########################################### -->
  <!-- 9.4 Definition of External operator         -->
  <!-- ########################################### -->
  <xsd:complexType name="ExternalOperator">
   <xsd:attribute name="name" type="erl:ExternalOprType"/>
  </xsd:complexType>
  <xsd:simpleType name="ExternalOprType">
   <xsd:restriction base="xsd:string">
    <xsd:enumeration value="AND"/>
    <xsd:enumeration value="OR"/>
    <xsd:enumeration value="XOR"/>
    <xsd:enumeration value="NOT"/>
    <xsd:enumeration value="("/>
    <xsd:enumeration value=")"/>
   </xsd:restriction>
  </xsd:simpleType>

  <!-- ########################################### -->
  <!-- 9.5 Definition of Internal operator         -->
  <!-- ########################################### -->
  <xsd:attributeGroup name="InternalOperator">
   <xsd:attribute name="name" type="erl:InternalOprType"/>
   <xsd:attribute name="location" type="erl:InternalOprLocationType"/>
  </xsd:attributeGroup>
  <xsd:simpleType name="InternalOprType">
   <xsd:restriction base="xsd:string">
    <xsd:enumeration value="&gt;"/>
    <xsd:enumeration value="&lt;"/>
    <xsd:enumeration value="&gt;="/>
    <xsd:enumeration value="&lt;="/>
    <xsd:enumeration value="&gt;&lt;"/>
    <xsd:enumeration value="="/>
    <xsd:enumeration value="+"/>
    <xsd:enumeration value="-"/>
    <xsd:enumeration value="*"/>
    <xsd:enumeration value="/"/>
    <xsd:enumeration value="%"/>
    <xsd:enumeration value="("/>
    <xsd:enumeration value=")"/>
   </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="InternalOprLocationType">
   <xsd:restriction base="xsd:string">
    <xsd:enumeration value="prefix"/>
    <xsd:enumeration value="infix"/>
    <xsd:enumeration value="postfix"/>
   </xsd:restriction>
  </xsd:simpleType>
  <!-- ########################################### -->
  <!-- 9.6 Definition of DescriptionType           -->
  <!-- ########################################### -->
  <xsd:simpleType name="DescriptionType">
   <xsd:restriction base="xsd:string"/>
  </xsd:simpleType>
  <!-- ########################################### -->
  <!-- 9.8 Definition of RecipientType             -->
  <!-- ########################################### -->
  <xsd:complexType name="RecipientType">
   <xsd:sequence>
```


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```
      <xsd:element ref="erl:PeerId"/>
      <xsd:element ref="erl:UserId" minOccurs="0"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:schema>
```

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Annex B
(informative)

An Example Event Report Request

This Annex provides an illustrative example of an Event Report Request. Note that this example does not show embedding of the Event Report Request into a Digital Item.

```
<?xml version="1.0" encoding="UTF-8"?>
<ERR xmlns="urn:mpeg:mpeg21:2005:01-ERL-NS" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-
R-NS"
  xmlns:sx="urn:mpeg:mpeg21:2003:01-REL-SX-NS"
xmlns:dia="urn:mpeg:mpeg21:2003:01-DIA-NS"
  xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS"
xmlns:dsig="http://www.w3.org/2000/09/xmldsig#"
  xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004" xmlns:r="urn:mpeg:mpeg21:2003:01-REL-
R-NS"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="urn:mpeg:mpeg21:2005:01-ERL-NS 21000-15-ER-SoFCD.xsd">
  <ERRDescriptor>
    <LifeTime>
      <StartTime>2004-07-01T00:00:00</StartTime>
      <EndTime>2004-07-08T00:00:00</EndTime>
    </LifeTime>
    <Modification>
      <PeerId>GUID:1AC5-4527-A864-3EA2</PeerId>
      <UserId>CISAC:IPI:P-1435 6382</UserId>
      <Time>2004-06-30T18:15:00</Time>
      <Description>Creation of ER-R by Bob@acme.org</Description>
    </Modification>
    <Modification>
      <PeerId>GUID:54A9-32CA-9836-AC30</PeerId>
      <UserId>CISAC:IPI:P-1435 6382</UserId>
      <Time>2004-07-05T24:00:00</Time>
    </Modification>
    <Priority>1</Priority>
  </ERRDescriptor>
  <ERSpecification>
    <Identifier xmlns="urn:mpeg:mpeg21:2002:01-DII-
NS">urn:mpegRA:mpeg21:dii:cid:1702</Identifier>
    <ERDescription>This is a description of the ER</ERDescription>
    <AccessControl/>
    <ERPayloadSpecification>
      <ERIdentifier baseId="true">urn:isbn:0-395-36341-1</ERIdentifier>
      <PeerId/>
      <UserId/>
      <Time/>
      <Location/>
      <DIOperation/>
      <DomainData reportTag="Name" semantics="acme:PhoneName"
syntax="xsd:String"/>
      <DomainData semantics="AcmeFilm:length" syntax="xsd:Integer" value="155"/>
      <DIMetadata>
       <DISelection>
        <DISelectionViaDII> urn:mpegra:mpeg21:dii:isrc:BE-R45-98-03948576
        </DISelectionViaDII>
```

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```
      </DISelection>
      <DIMetadataElement tagName="Title"/>
      <DIMetadataElement tagName="Artist"/>
      <DIMetadataElement tagName="ISWC"/>
    </DIMetadata>
  </ERPayloadSpecification>
  <ERFormatSpecification>
    <Ref>http://www.acme.org/schemas/phones.xsd</Ref>
  </ERFormatSpecification>
  <ERDeliverySpecification>
    <Recipient>
     <PeerId>urn:MAC:00-08-E3-AE-1E-62</PeerId>
     <UserId>urn:mpegra:mpeg21:IPI:0012395868374</UserId>
    </Recipient>
    <DeliveryTime>
     <SpecificTime>
      <AfterOn>2005-07-06T00:00:00</AfterOn>
      <BeforeOn>2005-09-06T00:00:00</BeforeOn>
     </SpecificTime>
    </DeliveryTime>
    <DITransportService>
     <r:serviceReference>
      <sx:wsdlComplete>
       <sx:wsdl>
        <nonSecureIndirect URI="http://www.acme.org/ER-wsdlfile.xml"/>
       </sx:wsdl>
       <sx:service>er:SendERService</sx:service>
       <sx:portType>er:SendERPortType</sx:portType>
      </sx:wsdlComplete>
     </r:serviceReference>
    </DITransportService>
  </ERDeliverySpecification>
  <EmbeddedERR>
    <ERRReference>mpeg:mpeg21:dii:ERRID:010</ERRReference>
  </EmbeddedERR>
 </ERSpecification>
 <EventConditionDescriptor>
  <TimeCondition>
    <TimeEvent>
     <SpecificTime>
      <AfterOn>2005-01-01T00:00:00</AfterOn>
      <BeforeOn>2005-01-31T00:00:00</BeforeOn>
     </SpecificTime>
    </TimeEvent>
    <Operator Name="OR"/>
    <TimeEvent>
     <PeriodicTime>
      <Start>2005-07-06T00:00:00</Start>
      <Period>P2M10D</Period>
      <Duration>P1D</Duration>
      <End>2006-07-06T00:00:00</End>
     </PeriodicTime>
    </TimeEvent>
  </TimeCondition>
  <Operator Name="AND"/>
  <DIOperationCondition>
    <DIOperationEvent>
     <Operation>REL:Play</Operation>
     <DII>mpeg:mpeg21:dii:ID:ACME-010</DII>
    </DIOperationEvent>
```

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```
    </DIOperationCondition>
    <Operator Name="AND"/>
    <PeerCondition>
      <PeerEvent Name="=" Location="infix">
       <mpeg7:Region>au</mpeg7:Region>
      </PeerEvent>
      <Operator Name="OR"/>
      <PeerEvent Name="=" Location="infix">
       <mpeg7:Region>kr</mpeg7:Region>
      </PeerEvent>
    </PeerCondition>
  </EventConditionDescriptor>
</ERR>
```

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Annex C
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An Example Event Report

This Annex provides an illustrative example of an Event Report which has been created after processing of an Event Report Request. Note that this example does not show embedding of the Event Report into a Digital Item.

```
<?xml version="1.0" encoding="UTF-8"?>
<ER xmlns="urn:mpeg:mpeg21:2005:01-ERL-NS"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
    xsi:schemaLocation="urn:mpeg:mpeg21:2005:01-ERL-NS
file:/C:/projects/workspace/aat_ER_FCD/21000-15-ER-SoFCD.xsd">
    <ERDescriptor>
        <Description>
            A Free-text description of the ER
        </Description>
        <Recipient>
            <PeerId>urn:MAC:00-08-E3-AE-1E-62</PeerId>
            <UserId>urn:mpegra:mpeg21:IPI:0012395868374</UserId>
        </Recipient>
        <Status value="true"/>
        <Modification>
            <PeerId>urn:MAC:00-18-53-AE-1C-BB</PeerId>
            <UserId>urn:mpegra:mpeg21:IPI:0017785868443</UserId>
            <Time>2005-11-03T01:22:30</Time>
        </Modification>
        <ERSource>
            <ERRReference>mpeg:mpeg21:dii:ERRID:342</ERRReference>
        </ERSource>
    </ERDescriptor>
    <ERData>
        <PeerId>urn:mpegra:mpeg21:IAN:0573495876574</PeerId>
        <UserId>urn:mpegra:mpeg21:IPI:0012395848221</UserId>
        <Time>2005-11-02T05:11:32</Time>
        <Location>
          <mpeg7:Region>au</mpeg7:Region>
        </Location>
        <DIOperation>REL:Play</DIOperation>
        <ReportedDomainData semantics="acme:PhoneName">
            <Name>AcmeModel231-ANS</Name>
        </ReportedDomainData>
        <ReportedDomainData>
            <AcmeFilm:length>155</AcmeFilm:length>
        </ReportedDomainData>
        <ReportedDIMetadata>
            <Title>A very catchy Tune</Title>
            <Artist>The hippest guys on the Block</Artist>
            <ISWC>T-345246800-1</ISWC>
        </ReportedDIMetadata>
    </ERData>
</ER>
```

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Annex D
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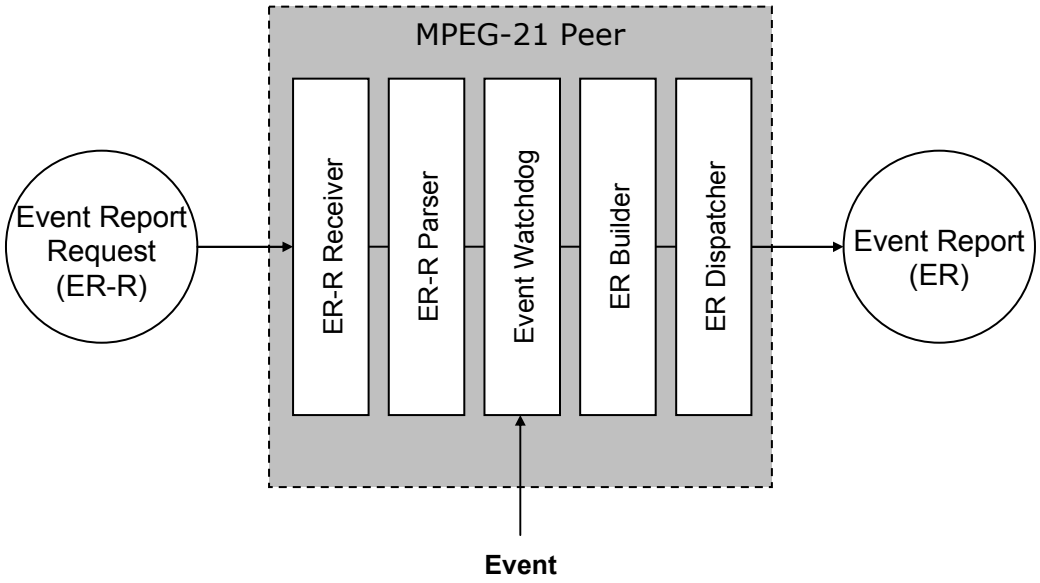
A description of Event Reporting processes

D.1 Motivation

This Annex aims to provide insight into how Event Report Requests (ER-R's) could be processed by a Peer and the processes that would occur before an associated Event Report would be generated. Its purpose is to provide insight to users of this Specification into how it can be applied in practice. Note that this is purely informative and should not be taken to be a normative prescription of how to process ER-R's and create ER's.

D.2 General Model and Processes

In subclause 6.1, a general model of Event Reporting was given in Figure 1 which is reproduced below for the reader's conveneince.



In this general model, a number of functional blocks were identified. The general flow of operation is as follows:

The ER-R Receiver obtains a Digital Item (DI) (it may be pushed to it or it may be actively pulled from another Peer) that contains an ER-R inside it. The ER-R is actually a component that deals exclusively with the transport aspects of moving a DI from one Peer to another and could use any type of mechanism that is convenient to the Peer creators. Examples include Web Services, RMI, Beep or even Proprietary protocols over TCP/IP sockets (which is potentially not very interoperable). This DI is passed on to the ER-R Parser for processing.

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The ER-R parser is a component that needs to be able to interpret the DI and extract the embedded ER-R from it. Having extracted the ER-R is checks it for well-formedness and also correctness (compliance with the specification). Note that this component could be very similar to the 21000-15 Reference Software, which also performs checking of ER-R's. When the ER-R has been checked, it can then be parsed into a DOM structure. This DOM can then be passed on to the Event Watchdog.

The Event Watchdog interprets the DOM and extracts all of the Conditions that have been specified in the ER-R. These conditions are "handed off" to their associated Condition Handlers (one each for Peer, Time and DI-related conditions). With all of the conditions placed into the care of the Condition Handlers, the Event Watchdog then waits until each of the conditions associated with a given ER-R have been fulfilled. The Event watchdog is then "fed" events (as they occur) from the Peer, a Timer and also the DIP Runtime (these interfaces are not shown in the diagram). These events serve as "inputs" to the Event Watchdog which compares them with the active ER-R's that it is currently processing (the Event Watchdog may concurrently multiple ER-R's).

When any of the ER-Rs' has all of its conditions fulfilled (according to the Boolean combination of conditions that was specified in the ER-R), then the ERBuilder is triggered. It is provided with the ER-R that has been fulfilled. It takes this ER-R and extracts the `ERPayloadSpecification` which indicates the data items that need to be included in the resulting ER. The ERBuilder then obtains the specified metrics, either from:

— the Peer (for Peer-specific data items),

— the DIP Engine (for `DIOperation` data items)

— domain-specific data sources (for any `DomainData` elements)

— the DI that was operated on (to obtain `DIMetadata` data items)

With these reportable data items, the ERBuilder is able to create the ER, once it has determined the Structure that it needs to use for the ER. This comes from the optional `ERFormat` element which will either specifiy a schema (that can be inline or a reference), or a mime-type that should be used to define the ER structure. If no ERFormat was specified, then the default format is used. When the ER has been built, it is passed on to the ERDispatcher, along with the `ERDeliverySpecification` element.

The ERDispatcher extracts the User, Peer and DITransport mechanism and then delivers the resulting DI to the specified recipient using the specified mechanism after:

— embedding it within a DI,

— identifying it according to the `ERDescription`'s `Identifier` and

— applying the optional specified `AccessRights` to the DI (if it was provided in the `ERDescription`).

The Sample Digital Item with an embedded ER-R shown in Annex B, and its associated Digital Item with an embedded Event Report shown in Annex C can be created using the approach outlined in this Annex.

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