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Information technology — Multimedia framework (MPEG-21) —

Part 23: **Smart Contracts for Media**

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

Partie 23: Contrats intelligents pour les médias

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Foreword

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

A list of all parts in the ISO/IEC 21000 series can be found on the ISO and IEC websites.

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Introduction

The Moving Picture Experts Group (MPEG) standards include a set of RDF ontologies for the codification of intellectual property (IP) rights information related to media. The ISO/IEC 21000-19 Media Value Chain Ontology (MVCO) which facilitates rights tracking for fair, timely, and transparent payment of royalties by capturing user roles and their permissible actions on a particular IP entity. The ISO/IEC 21000-19/AMD1 Audio Value Chain Ontology (AVCO) which extends MVCO functionality related to the description of IP entities in the audio domain (e.g. multitrack audio and time segments). The ISO/IEC 21000-21 Media Contract Ontology (MCO) which facilitates the conversion of narrative contracts to digital ones related to exploitation of IP rights, payments and notifications. With respect to the latter, an equivalent standard has also been developed but using XML schemas, known as ISO/IEC 21000-20 Contract Expression Language (CEL).

Furthermore, the axioms in these XML schemas and RDF ontologies can drive the execution of rights-related workflows in controlled environments, for example, Distributed Ledger Technologies (DLTs), where transparency and interoperability are favored toward fair trade of music and media. Thus, the aim of this document is to provide the means (e.g. protocols and application programming interfaces) for converting these XML and RDF media contracts to smart contracts executable on existing DLT environments.

By doing this conversion in a standard way for several smart contract languages it is going to ensure that MPEG schemas and ontologies prevail as the interlingua for transferring verified contractual data from one DLT to another.

Information technology — Multimedia framework (MPEG-21) —

Part 23: Smart Contracts for Media

1 Scope

This document specifies the means (e.g. protocols and application programming interfaces) for converting MPEG-21 XML and RDF media contracts (ISO/IEC 21000-19, ISO/IEC 21000-20, and ISO/IEC 21000-21) to smart contracts executable on existing DLT environments.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 21000-19, *Information technology — Multimedia framework (MPEG-21) — Part 19: Media Value Chain Ontology*

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

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

3 Terms, definitions, symbols, and abbreviated terms

3.1 Terms and definitions

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

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

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

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

3.1.1
DLT
distributed ledger technology
distributed network of computers, ideally organized in a decentralized way, mutually agreeing on a common state while tolerating failures (including malicious behavior) to some extent

3.1.2
smart contract
code deployed in a DLT or the source code from which such code was compiled

Note 1 to entry: The execution of smart contract instructions is distributed among the nodes of the DLT in which it is deployed to. This execution is triggered via a DLT transaction and produces a change in the DLT state.

3.1.3
smart contract language
programming language used for creating the code of a smart contract, that is then compiled in another code deployable to a specific DLT

3.1.4
smart contract template
source code of a smart contract written using a specific smart contract language for defining a common behavior.

3.1.5
smart contract specification
set of information needed for the deployment of a smart contract and for populating the data structures that the smart contract instructions are interacting with

3.1.6
DLT address
product of a cryptographic schema operation used to represent identities in a DLT

3.1.7
DLT governance
specification indicating the set of rules followed by the specific DLT protocol

3.1.8
token
object stored in a DLT and managed through one or more smart contracts, representing unique tangible or intangible media assets, possessions, and accountable items

3.1.9
fungible token
token being changeable with other tokens

3.1.10
non-fungible token
token being non interchangeable with other tokens

3.1.11
MPEG-21 CEL/MCO contract
contract represented using ISO/IEC 21000-19, ISO/IEC 21000-20 and ISO/IEC 21000-21 elements

3.1.12
media contractual objects
set of machine-readable objects extracted from a specific MPEG-21 CEL/MCO contract

3.1.13
smart contract for media
deployed smart contract that is the result of the conversion process from a specific MPEG-21 CEL/MCO contract

3.1.14
parser
software component that extracts a set of media contractual objects from an MPEG-21 CEL/MCO contract or a smart contract for media

3.1.15
generator
software component that from a set of media contractual objects generates an MPEG-21 CEL/MCO contract or a smart contract specification

3.1.16
DLT tokens and payments manager
component deploying a smart contract for media on a specific DLT

3.1.17
contract developer
actor providing the means to generate an MPEG-21 CEL/MCO contract or a smart contract in a specific smart contract language (e.g. smart contract templates)

3.1.18
DLT system engineer
actor providing the information needed to deploy a smart contract in a specific DLT (e.g. DLT addresses and governance)

3.2 Abbreviated terms

MVCO	media value chain ontology
AVCO	audio value chain ontology
CEL	contract expression language
MCO	media contract ontology
CEL/MCO	ISO/IEC 21000-19, ISO/IEC 21000-20, and ISO/IEC 21000-21
IP	intellectual property
API	application programming interface

4 Conventions

4.1 Classes representation

The following conventions derive from the Object-Oriented Programming paradigm. In this sense Application Programming Interfaces (APIs) are represented in terms of Classes definitions and Objects.

An Object is an instantiation of a Class while a Class contains the following properties:

— Name of the represented object.

— Type of the represented object. An object Type may be:

  — Abstract which is only showing essential information with respect to an interface, but it cannot be implemented; or,

  — Concrete which is a complete specification that can be implemented.

— Hierarchy with respect to the other objects; it also introduces the sub-class which is a class that inherits the complete set of fields and methods of its super-class.

— Fields which describe the attributes associated to the represented object; Fields consist of a specific Field Type and the number of Occurrences.

— Methods which are operations performed by manipulating the object Fields; Methods accept as input a specific set of Parameter Types and provide as output a specific set of Return Types.

In the following, Table 1 shows the notation for representing Classes with respect to MPEG-21 CEL/MCO objects, while Table 2 describes the Types used for Fields, Parameters and Returns.

Table 1 — Classes notation with respect to MPEG-21 CEL/MCO

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
ClassName1	Abstract or Concrete, sub-class of ClassName2		*referenceToCELObject1*	*referenceToMCOObject1*
Fields				
Type	**Field and Description**	**Occ.**		
FieldName1Type	FieldName1	0, 1 or 1, n	*referenceToCELObject2*	*referenceToMCOObject2*

Methods		
Parameters	**Method and Description**	**Return**
ParameterType1	method1()	ReturnType1

Table 2 — Types used for Fields, Parameters and Returns

Type	**Description**
string	A sequence of characters
ushort	An unsigned integer number represented through 2 bytes
ulong	An unsigned integer number represented through 4 or 8 bytes
float	A floating-point number, that is a number that can contain a fractional part, represented through 4 or 8 bytes
enum	A set of enumerated named elements
boolean	A dyadic value with two possible values, True and False
typeName []	An array of elements of type typeName
map(typeName1, typeName2)	A key value mapping where the key of type typeName is used to retrieve a value of type typeName2
void	A type used to represent "no data"
idref	A type used to represent a reference to a specific object, e.g. class instance. The form of classNameIdref is used to reference objects that instantiate the class className, e.g. contractIdref refers to objects that instantiate the contract class.

4.2 Namespace prefixes

Table 3 below shows the namespace prefixes for the MPEG-21 CEL/MCO standards and other related schemas together with their references.

Table 3 — Mapping of prefixes to namespaces for the MPEG-21 CEL/MCO standards and other related schemas

Prefix	**Corresponding namespace**	**References**
dc	https://purl.org/dc/elements/1.1/	ISO 15836 [1]
dii	urn:mpeg:mpeg21:2002:01-DII-NS#	ISO/IEC 21000-3[2]
vcard	http://www.w3.org/2006/vcard/ns#	IETF RFC 2426[3]
mvco	https://purl.oclc.org/NET/mvco.owl#	ISO/IEC 21000-19
avco	https://purl.oclc.org/NET/aumvco.owl#	ISO/IEC 21000-19/Amd1
cel-core	urn:mpeg:mpeg21:cel:core:2015#	ISO/IEC 21000-20:2016
cel-ipre	urn:mpeg:mpeg21:cel:ipre:2015#	ISO/IEC 21000-20:2016

Table 3 *(continued)*

Prefix	Corresponding namespace	References
cel-pane	urn:mpeg:mpeg21:cel:pane:2015#	ISO/IEC 21000-20:2016
cel-rele	urn:mpeg:mpeg21:cel:rele:2015#	ISO/IEC 21000-20:2016
mco-core	urn:mpeg:mpeg21:mco:core:2015#	ISO/IEC 21000-21:2017
mco-ipre	urn:mpeg:mpeg21:mco:ipre:2015#	ISO/IEC 21000-21:2017
mco-pane	urn:mpeg:mpeg21:mco:pane:2015#	ISO/IEC 21000-21:2017
mco-rele	urn:mpeg:mpeg21:mco:rele:2015#	ISO/IEC 21000-21:2017

5 Overview

5.1 General aspects

MPEG-21 CEL/MCO schemas and ontologies can be used by music and media value chain stakeholders to share and exchange, in an interoperable way, all metadata and contractual information connected to creative works, leading to transparent payment of royalties and reduced time spent searching for the right data. The latter is due to inference and reasoning capabilities inherently associated with ontologies. That is, knowledge and data can be derived by evidence and logic based on rich semantic copyright models expressed by MPEG-21 CEL/MCO schemas and ontologies. In this way, the data derived are unambiguously interpretable, facilitating efficient processing in business-to-consumer (B2C) and business-to-business (B2B) music and media value chains.

Furthermore, for contractual music and media asset trading, smart contracts can be used to encode the terms and conditions of a contract. They validate contractual agreements between stakeholders before a DLT value transfer is enabled. In other words, smart contracts could allow music and media royalties to be administered almost instantaneously and manage usage allowances and restrictions. Rather than passing through intermediaries, revenue from a stream or download could be distributed automatically to rights holders, according to agreed terms and conditions (e.g. splits), as soon as an asset is downloaded or streamed.

Therefore, the challenge is converting MPEG-21 CEL/MCO standardized schemas and ontologies to smart contracts that can be executed on existing DLT environments, thus enriching DLT environments with inference and reasoning capabilities inherently associated with ontologies. Note that this process will increase trust among music and media value chain stakeholders for sharing data in the ecosystem since the data will be cryptographically secured and verified on a DLT. By addressing this challenge in a standard and agnostic way, with respect to smart contract languages and thus DLT environments, it would also ensure that MPEG-21 CEL/MCO schemas and ontologies prevail as the interlingua for transferring verified contractual data from one DLT to another[4].

5.2 Relationships between MPEG-21 CEL/MCO and DLTs

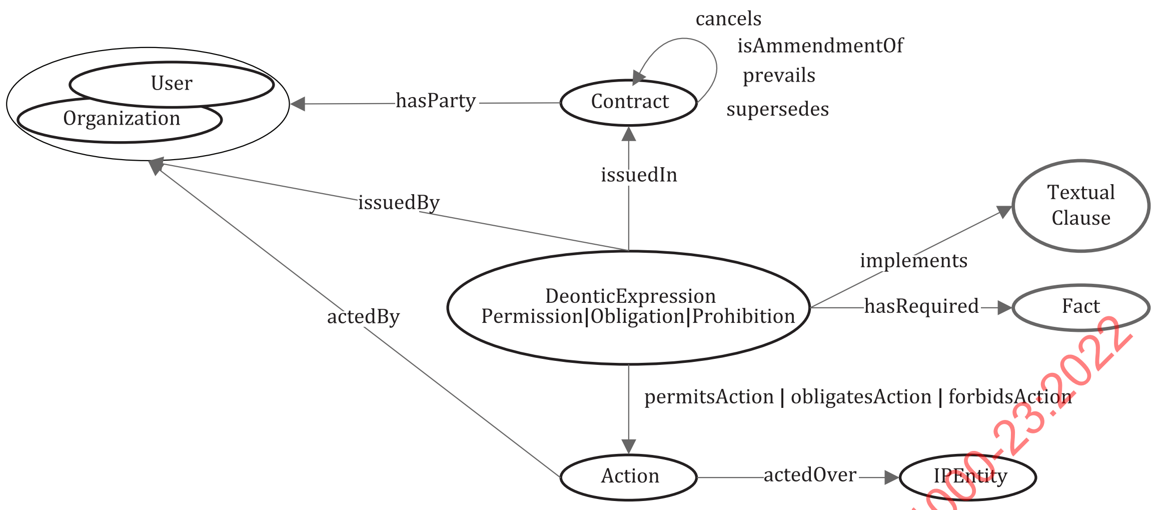
This subclause describes the relationships between MPEG-21 CEL/MCO elements and DLTs components, for the conversion of MPEG-21 CEL/MCO contracts to smart contracts for media and vice versa. Smart contracts for media are distinguished from generic smart contracts since they are the result of the conversion process from a specific MPEG-21 CEL/MCO contract.

For the description of above-mentioned relationships, the main elements identified for MPEG-21 CEL/MCO are the contract, the party, the IP entity, and the deontic expression. The counterparts in a DLT-based scenario have been identified as shown in Table 4.

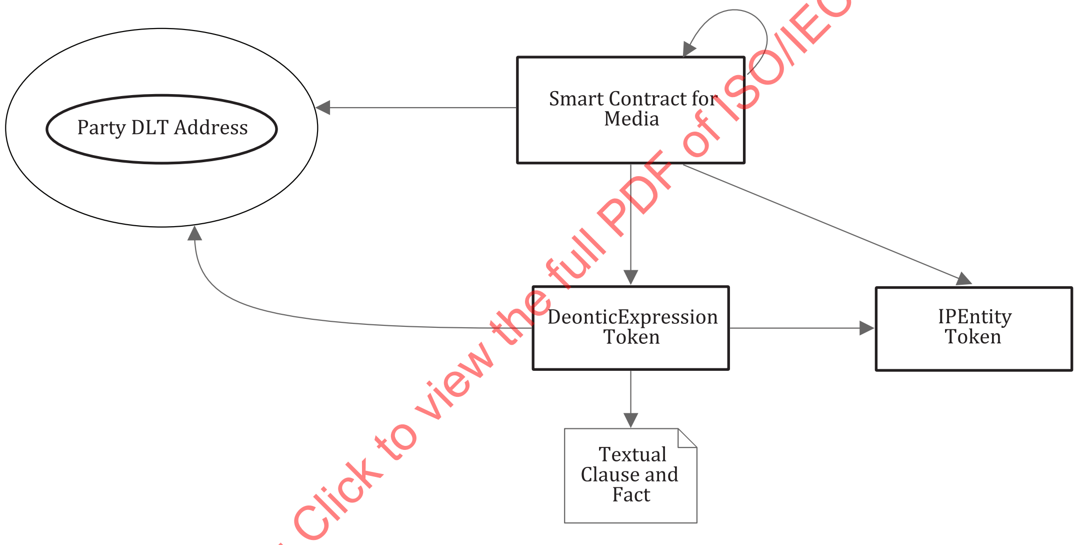
Table 4 — Relationships between MPEG-21 CEL/MCO elements and DLTs components

MPEG-21 CEL/MCO	**DLTs**
Contract	Smart contract for media
Party	DLT address
IP entity	Non-fungible token
Deontic expression	Non-fungible token

Furthermore, in Figure 1, as for example, the relationships between MPEG-21 MCO and DLTs are depicted, albeit similar relationships apply between MPEG-21 CEL and DLTs. These relationships are further explained in the following.



a) ISO/IEC 21000-21:2017 Media Contract Ontology



b) Relationship between ISO/IEC 21000-21:2017 Media Contract Ontology and DLTs

Key

▭	smart contract and/or token
⬭	DLT identity
🗋	text
←	refers to

Figure 1 — Relationships between MPEG-21 MCO elements and DLTs components

1) **Contract – Smart contract for media:** the MPEG-21 CEL/MCO contract element is the one that includes or refers to the digitalized contractual information extracted from a narrative contract. Whilst the smart contract for media is the result of the conversion process from the MPEG-21 CEL/MCO contract. Thus, the counterpart of an instance of an MPEG-21 CEL/MCO contract is a unique smart contract for media deployed on a specific DLT.

2) **Party – DLT address:** a Party element is the representation of the identity of a user or organization bound by the narrative contract. Since identities in DLTs are represented through addresses, the

Party element counterpart is a DLT address. Thus, a Party identity represented by a DLT address may also be authenticated in the DLT and referenced in a smart contract for media.

3) **IP entity – Non-fungible token:** an IP Entity element is the representation of an asset, and the reference to this asset can be stored on a DLT. This representation of an asset may be serialized according to the concept of non-fungible tokens. Thus, in smart contracts an IP Entity may be represented by a token. Then, the entire set of information related to a specific IP Entity is linkable to the associated token. Two reasons support this approach:

   i) the linkage between IP Entities and related smart contracts for media is maintained at a high level, particularly when DLTs offer append-only data storage and not a more complex one;

   ii) it makes feasible the process of auditing, exploiting at best the immutability feature of DLTs; the history of all operations executed over an IP Entity, indeed, can be found in one place.

4) **Deontic expression – Non-fungible token**: a Deontic Expression encompasses the properties of an agreed machine-readable contract clause regulating the actions of the Parties (e.g. obligations, permissions, and prohibitions). This representation of a clause may also be serialized according to the concept of non-fungible tokens. The reasons for supporting this approach are:

   i) it enables a unique way for storing clauses on DLTs, that is also beneficial in terms of interoperability, for sharing these clauses with other DLT-based applications;

   ii) it allows the transfer of value in the form of obligations, permissions and prohibitions, similarly to how cryptocurrency transfers are done.

6 Bidirectional conversion between MPEG-21 CEL/MCO contracts and smart contracts for media

This clause describes the bidirectional conversion processes between MPEG-21 CEL/MCO contracts and smart contracts for media. In Figure 2 it is shown the forward conversion from MPEG-21 CEL/MCO contracts to smart contracts for media, while, in Figure 3 it is shown the backward conversion from smart contracts for media to MPEG-21 CEL/MCO contracts.

Both processes interact with several actors and DLTs where a smart contract for media would be (forward conversion) or has been (backward conversion) deployed. In the following subclauses, a set of interrelated components are described, each of which consists of a grouping of related functionality encapsulated behind a well-defined interface (e.g. inputs and outputs).

The smart contract for media may store instances of the MPEG-21 CEL/MCO contract elements either:

— in data structures of the smart contract for media; or

— in non-fungible tokens referenced by the smart contract for media, which are stored on the same DLT but managed through a different smart contract.

By storing these elements in that way, this document also facilitates the backward conversion from smart contracts for media to MPEG-21 CEL/MCO contracts in the XML[5]/RDF[6] form. In turn, MPEG-21 CEL/MCO contracts may be transformed into narrative contracts.

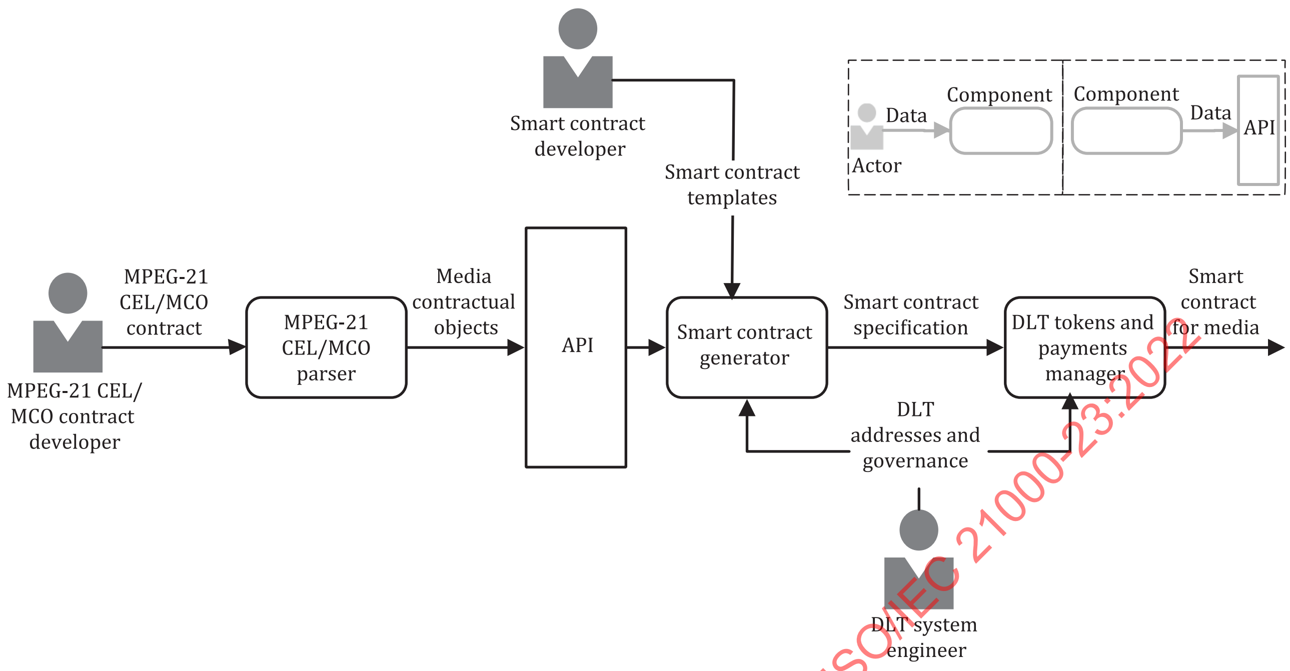


Figure 2 — Conversion workflow from MPEG-21 CEL/MCO contracts to smart contracts for media

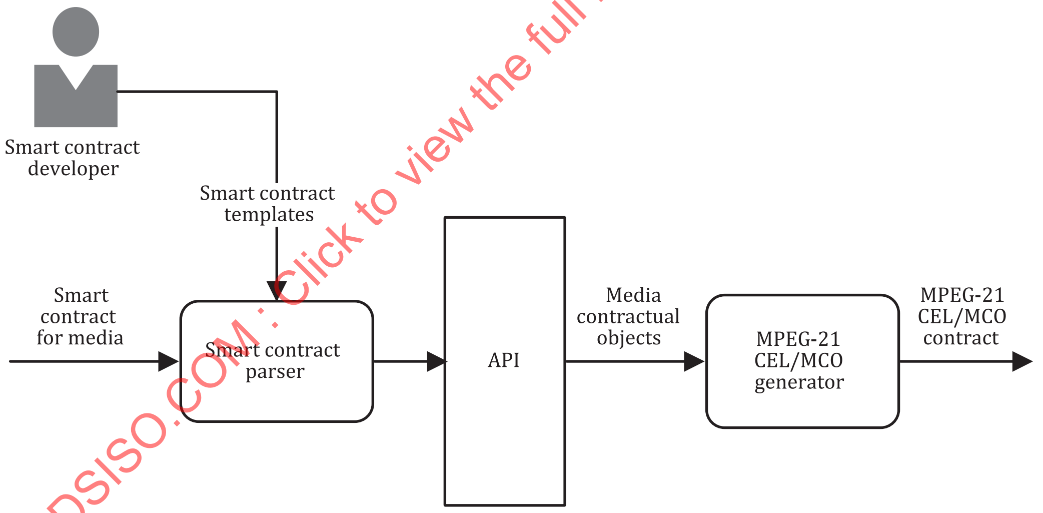


Figure 3 — Conversion workflow from smart contracts for media to MPEG-21 CEL/MCO contracts

6.1 Conversion from MPEG-21 CEL/MCO contracts to smart contracts for media

The process of conversion from an MPEG-21 CEL/MCO contract to a smart contract for media involves the execution of several components and the interaction with three actors and a DLT. This process is graphically illustrated in Figure 2.

6.1.1 MPEG-21 CEL/MCO parser

The MPEG-21 CEL/MCO parser component gets as input an MPEG-21 CEL/MCO contract, provided by an MPEG-21 CEL/MCO contract developer, and produces a set of media contractual objects. It is expected that the MPEG-21 CEL/MCO contract has been checked to be syntactically and semantically valid. Otherwise, the validation result provided by the MPEG-21 CEL/MCO parser returns two levels of information:

1. **Errors**: syntactic or semantic errors are identified.
2. **Warnings**: elements of information that may be lost during the conversion process.

Input:

— **MPEG-21 CEL/MCO contract**: it consists of XML/RDF documents containing one or several MPEG-21 CEL/MCO elements that represent a contract.

Output:

— **Media contractual objects**: a structured set of information related to the deontic expressions, actions, entities, and constraints extracted from an MPEG-21 CEL/MCO contract.

These media contractual objects are only dependent upon the MPEG-21 CEL/MCO standards and as such are agnostic with respect to any specific DLT.

6.1.2 Smart contract generator

The smart contract generator component produces a smart contract specification by combining information related to an MPEG-21 CEL/MCO contract in the form of media contractual objects with some specific smart contracts templates. This component is meant to be dependent on the smart contract language.

Inputs:

— **Media contractual objects**: a set of media contractual objects is needed to define the information that is contained in the smart contract for media.

— **Smart contract templates**: the DLT smart contract developer (e.g. the person skilled in the specific DLT smart contract language) elaborates a set of specific smart contract templates to be utilized in the conversion process.

Output:

— **Smart contract specification**: a set of elements that represent the information needed by the DLT tokens and payments manager component to deploy the smart contract for media.

This smart contract specification includes information produced based on the objects found while traversing the set of media contractual objects. If MPEG-21 CEL/MCO obligations including payments are found, then the smart contract generator produces the information needed for creating revenue functions for each party involved. For instance, if a party is obliged to share its revenue with another party, then a smart contract method performs the revenue sharing function (e.g. royalties flow). Moreover, for each MPEG-21 CEL/MCO deontic expression and IP entity found in the media contractual objects, the smart contract generator produces the information needed for creating a new non-fungible token.

6.1.3 DLT tokens and payments manager

The purpose of the DLT tokens and payments manager component is to deploy the smart contract for media that derives from a smart contract specification, a set of DLT addresses and a DLT governance protocol. Both the DLT addresses and the DLT governance protocol are required for the operation in a specific DLT environment and are provided by a DLT system engineer.

Inputs:

— **Smart contract specification**: this specification enables the creation of a smart contract for media instance, which includes specific tokens and payments information.

— **DLT addresses**: this input refers to the bindings between MPEG-21 CEL/MCO contract parties and DLT addresses.

— **DLT governance**: the protocol the specific DLT adheres to that allows the DLT tokens and payments manager component to update the ledger.

Output:

— **Smart contract for media**: the result of the execution of the DLT tokens and payments manager component is the deployed smart contract for media.

The DLT tokens and payments manager component performs some checks on whether each token referenced in the smart contract specification has already been in existence on the DLT. If this is not the case, it creates a new token and stores its reference in the smart contract for media.

The DLT tokens and payments manager component may store an MPEG-21 CEL/MCO element in a token, or store in a token an immutable reference of it and then the element itself outside of the DLT. The second mechanism is preferred when the element information needs to be kept private or when the DLT disincentives data storage.

6.2 Conversion from smart contracts for media to MPEG-21 CEL/MCO contracts

The process of conversion from a smart contract for media to an MPEG-21 CEL/MCO contract involves the execution of two components and the interaction with a DLT and a DLT smart contract developer. This process is graphically illustrated in Figure 3.

6.2.1 Smart contract parser

The smart contract parser is a component that fetches the data of a deployed smart contract for media, which uses to produce a set of media contractual objects.

Inputs:

— **Smart contract for media**: the parser fetches the data from a deployed smart contract for media.

— **Smart contract template**: a template is required for decoding the data structures within the smart contract for media.

Output:

— **Media contractual objects**: a set of media contractual objects extracted from the information contained in the smart contract for media.

6.2.2 MPEG-21 CEL/MCO generator

The MPEG-21 CEL/MCO generator is a component performing the backward operation with respect to the MPEG-21 CEL/MCO parser described previously. That is, the MPEG-21 CEL/MCO generator gets as input a set of media contractual objects and produces an MPEG-21 CEL/MCO contract.

Input:

— **Media contractual objects**: a set of media contractual objects extracted from the information contained in the smart contract for media.

Output:

— **MPEG-21 CEL/MCO contract**: an XML/RDF document containing one or several MPEG-21 CEL/MCO elements derived from the media contractual objects.

7 Narrative contracts

One shortcoming is that, generally, there is no way to deduce from a smart contract the clauses that the smart contract contains. Publishing the narrative contract does not ensure that the clauses of the narrative contract correspond to the clauses of the smart contract. There should be a way that allows the other party of the smart contract to know beyond doubt what the clauses stored in the smart contract express.

Thus, an important feature of this document is that it offers the possibility to bind, through persistent links, the clauses of a smart contract to the corresponding ones of the narrative contract and vice versa, e.g. the narrative clause x "user A pays $1 to user B" is bound to its counterpart smart contract clause x "Transfer UserA UserB $1". In the latter, if the beneficiary of the payment is not clear, the link to its corresponding narrative clause could be handy. In the following, the MPEG-21 CEL/MCO elements enabling such bindings are further described.

For example, the narrative version of contracts is preserved in MPEG-21 CEL contracts, either in plain text (cel-core:TextVersion) or encrypted (cel-core:EncryptedTextVersion). Further structuring is possible by means of cel-core:TextClause and cel-core:TextParagraph (in clear text or encrypted). These text elements can be referenced with the attribute 'idrefs' from the operative part of the contracts, maintaining the isomorphism (e.g. the one-to-one relationship between an operative clause to its narrative counterpart) explicitly.

Equivalently, MPEG-21 MCO contracts also preserve the narrative version of the contract, either in a complete form (using the mco-core:TextVersion property) or through a number of textual clauses which can also be referenced from the operative part. These clauses are instances of the mco-core: TextualClause, with mco-core:Text as a data property.

In that way, the narrative version of a contract and its clauses is represented in MPEG-21 CEL/MCO contracts, and these relationships are also maintained all the way through the media contractual objects (textVersion and textClauses) to smart contracts and vice versa. In turn, this ensures the parties signing a smart contract to know beyond doubt what the clauses stored in the smart contract express with respect to the clauses of the narrative contract.

By doing this conversion in a standard way for several smart contract languages would ensure MPEG-21 CEL/MCO contracts prevail as the interlingua for transferring verified contractual data from one DLT to another.

8 API for media contractual objects

This API, by facilitating the creation and handling of media contractual objects, is fundamental for the bidirectional conversion from MPEG-21 CEL/MCO contracts to smart contracts for media. Thus, this clause specifies the media contractual objects API. This API has been derived and shall be used in conjunction with MPEG-21 XML and RDF media contracts (ISO/IEC 21000-19, ISO/IEC 21000-20, and ISO/IEC 21000-21). The specific XML schemas and RDF ontologies contained in these standards are shown in Table 5. Furthermore, the presentation of this API follows the conventions (e.g. classes representation and namespace prefixes) as described in Clause 4.

Table 5 — Schemas and ontologies contained in MPEG-21 CEL/MCO

MPEG-21 CEL/MCO	Schemas and Ontologies
ISO/IEC 21000-19 Media Value Chain Ontology	MVCO
ISO/IEC 21000-19/AMD1 Audio Value Chain Ontology	AVCO

Table 5 *(continued)*

MPEG-21 CEL/MCO	Schemas and Ontologies
ISO/IEC 21000-21:2017 Media Contract Ontology	MCO-CORE, MCO Intellectual Property Rights Extension (MCO-IPRE), MCO Payments and Notifications Extension (MCO-PANE), MCO Right Expression Language Extension (MCO-RELE)
ISO/IEC 21000-20:2016 Contract Expression Language	CEL-CORE, CEL Intellectual Property Rights Extension (CEL-IPRE), CEL Payments and Notifications Extension (CEL-PANE), CEL Right Expression Language Extension (CEL-RELE)

8.1 Contract

8.1.1 Contract

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Contract	Concrete, sub-class of Encryptable		*cel-core:*Contract	*mco-core:*Contract
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the contract	1	*cel-core:*Contract contractId *(attribute)*	Internationalized Resource Identifier (IETF Standard is RFC 3987)
string	**governingLaw** Indicating the jurisdiction and applicable law	0, 1	*cel-core:*Contract governingLaw *(attribute)*	*mco-core:* hasGoverningLaw
string	**court** Has exclusive jurisdiction over any dispute related to the contract's terms and conditions	0, 1	*cel-core:*Contract court *(attribute)*	*mco-core:*hasCourt
boolean	**isCourtJurisdictionExclusive**	0, 1	isCourtJurisdictionExclusive	*mco-core:*isCourtJurisdictionExclusive
string	**textVersion** Whole narrative contract text	0, 1	*cel-core:*TextVersion	*mco-core:*TextVersion
string	encryptedTextVersion An encrypted version of the whole narrative contract text	0, 1	cel-core: EncryptedTextVersion	mco-core:encryptedContractPart
map (string, string)	**metadata** For giving information about the contract itself.	0, n	*cel-core:*Metadata Dublin Core (ISO 15836) or others	Dublin Core (ISO 15836) or others

Class			CEL	MCO
Name	**Type and Hierarchy**			
map (contractIdref, enum(contractRela-tions))	**contractRelations** Used to relate the contract to other identified contracts. The enum of the map value must be one of the following: 0 = supersedes 1 = cancels 2 = prevailsOver 3 = isAmendmentOf	0, n	*cel-core:* ContractsRelated	*mco-core:*contractObje ctProperty
map(partyIdref, Party)	**parties** Persons or organizations for which the contract is binding	0, n	*cel-core*:Party	*mco-core*:Party
map(personuserIdref, Per-sonUser)	**otherPersonUsers** Referenced Persons/Users for which the contract is not binding	0, n	*cel-core*:Person	*cel-core*:User
map(deonticIdref, Deontic)	**deontics** Machine-readable operative parts of the contract used to represent agreements	1, n	list of *cel-core*:Deo nticStructuredClause	list of *mco-core:* DeonticExpression
map(actionIdref, Action)	**actions** Specifies the rights that are permitted / obligated / pro-hibited to parties	1, n	list of *cel-core*:Act within a *cel-core*:Deo nticStructuredClause	list of *mco-core:* GenericAction within a *mco-core:* DeonticExpression
map(objectIdref, Object)	**objects** Resources against which the deontics will apply	0, n	list of *cel-core*:Object	list of *mco-core*:actedOver *mco-core*:IPEntity *mco-core*:Service
map(factIdref, Fact)	**facts** Conditions, restrictions and constraints within each deontic	0, n	cel-core:Constraint	*mvco*:Fact
map(textIdref, Text-Clause)	**textClauses** Text clauses to reference from a deontic expression to narrative contract excerpts of which it makes the opera-tive part	1, n	list of *cel-core*:TextClause	list of *mco-core*:TextualClause
map (encryptedIdref, string)	**encryptedContractParts** For addressing the encryp-tion needs regarding a part, or the entirety, of a contract document. The key value of the map must be the identifier of the part.	0, n	*cel-core:* EncryptedContract *cel-core:* EncryptedParty *cel-core:* EncryptedClause *cel-core:* EncryptedBlock	list of *mco-core*:encryptedCo ntractPart

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
map(deonticStructuredBlockIdref, CELDeonticStructuredBlock)	**operativePart** The contract part which contains the deontic expressions of the operative part. It embodies the set of related deontic clauses grouped as a nested structure (Specific for CEL)	0, n	*cel-core:*OperativePart *cel-core:*DeonticStructuredBlock	/
personuserIdref[]	**signatories** A signatory of a contract when different from a party (Specific for MCO)	0, n	/	*mco-core*:isSignedBy

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getGoverningLaw()**	string
void	**getCourt()** Has exclusive jurisdiction over any dispute related to the contract's terms and conditions	string
void	**getIsCourtJurisdictionExclusive()**	boolean
void	**getTextVersion()**	string
void	**getEncryptedTextVersion**()	string
void	**getMetadata()**	map (string, string)
string	**getMetadataBy()**	string
void	**getContractRelations()**	map (contractIdref, enum(contractRelations))
contractIdref	**getContractRelationsBy()**	enum(contractRelations)
void	**getParties()**	map(partyIdref, Parties)
partyIdref	**getPartyBy()**	Party
personuserIdref	**getPersonUserBy()** This method searches and possibly returns a PersonUser from the parties' map field	PersonUser
void	**getOtherPersonUsers()**	map(personuserIdref, PersonUser)
personuserIdref	**getOtherPersonUsersBy()**	PersonUser
void	**getDeontics()**	map(deonticIdref, Deontic)
deonticIdref	**getDeonticBy()**	Deontic
void	**getActions()**	map(actionIdref, Action)
actionIdref	**getActionBy()**	Action
void	**getObjects()**	map(objectIdref, Object)
objectIdref	**getObjectBy()**	Object

Methods		
Parameters	**Method and Description**	**Return**
itemIdref	**getItemBy()** This method searches and possibly returns an Item from the objects map field	Item
ipentityIdref	**getIPEntityBy()** This method searches and possibly returns an IPEntity from the objects map field	IPEntity
void	**getFacts()**	map(factIdref, Fact)
factIdref	**getFactBy()**	Fact
void	**getTextClauses()**	map(textIdref, TextClause)
textIdref	**getTextClausesBy()**	TextClause
void	**getEncryptedContractParts()**	map(encryptedIdref, string)
encryptedIdref	**getEncryptedContractPartsBy()**	string
void	**getOperativePart()**	map(deonticStructuredBlockIdref,CELDeonticStructuredBlock)
deonticStructuredBlockIdref	**getDeonticStructuredBlock()** This method returns information about a deontic structured block	CELDeonticStructuredBlock
void	**getConstraints()** This method consists in a call to the method getFacts()	map(factIdref, Fact)
void	**getExpressions()** This methods consists in a call to the method getDeontics()	deonticIdref[]
void	**getSignatories()**	personuserIdref[]
string	**Contract()** This method constructs a new object and gets as input only the identifier	void
string, map(deonticIdref,Deontic),map(actionIdref,Action), map(textIdref,TextClause)	**Contract()** This method constructs a new object and gets as input all the required fields	void
string	**setIdentifier()**	void
string	**setGoverningLaw()**	void
string	**setCourt()**	void
boolean	**setIsCourtJurisdictionExclusive()**	void
string	**setTextVersion()**	void
string	**setEncryptedTextVersion()**	void
map (string, string)	**setMetadata()**	void
string, string	**addMetadata()**	void
map(contractIdref, enum(contractRelations))	**setContractRelations()**	void
contractIdref, enum(contractRelations)	**addContractRelations()**	void
map(partyIdref, Parties)	**setParties()**	void
partyIdref, Parties	**addParties()**	void

Methods		
Parameters	**Method and Description**	**Return**
map(deonticIdref, Deontic)	**setDeontics()**	void
deonticIdref, Deontic	**addDeontics()**	void
map(actionIdref, Action)	**setActions()**	void
actionIdref, Action	**addActions()**	void
map(objectIdref, Object)	**setObjects()**	void
objectIdref, Object	**addObjects()**	void
map(factIdref, Fact)	**setFacts()**	void
factIdref, Fact	**addFacts()**	void
map(textIdref,TextClause)	**setTextClauses()**	void
textIdref,TextClause	**addTextClauses()**	void
map(encryptedIdref, string)	**setEncryptedContractParts()**	void
encryptedIdref, string	**addEncryptedContractParts()**	void
map(deonticStructuredBlock-Idref,CELDeonticStructured-Block)	**setOperativePart()**	void
deonticStructuredBlock-Idref,CELDeonticStructured-Block	**addOperativePart()**	void
deonticStructuredBlockIdref	**setDeonticStructuredBlock()**	void
map(factIdref, Fact)	**setConstraints()**	void
factIdref, Fact	**addConstraints()**	void
deonticIdref[]	**setExpressions()**	void
deonticIdref	**addExpressions()**	void
personuserIdref[]	**setSignatories()**	void
personuserIdref	**addSignatories()**	void

8.1.2 Encryptable

Class			CEL	MCO
Name	Type and Hierarchy			
Encryptable	Abstract		cel-core: EncryptedContract cel-core: EncryptedParty cel-core: EncryptedClause cel-core: EncryptedBlock	mco-core:encryptedContractPart
Fields				
Type	Field and Description	Occ.		
encryptedIdref	**encryptedRepresentation** A full version of the current contract part in an encrypted representation	0, 1	/	/

Methods		
Parameters	Method and Description	Return
void	**getEncryptedRepresentation()**	encryptedIdref

8.2 Party

8.2.1 Party

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Contract	Abstract, sub-class of Encryptable		*cel-core:*Party	*mco-core:*Party
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the party	1	*cel-core:*Party id *(attribute)*	*rdf:about*
string	**name** The name of the party	1	cel-core:Name	/
map (string, string)	**details** To provide further detailed contact information	0, n	*cel-core:*Details *xmlns:*vCard	*mco-core:*hasVCard
map (string, string)	**metadata** For giving information about the contract itself.	0, n	*dc:*description *dc:*identifier Dublin Core (ISO 15836) or others	Dublin Core (ISO 15836) or others
string	**address** Party address as free text	0, 1	*cel-core:*Address	*mco-core:*Address
deonticIdref[]	**deonticsIssued** Machine-readable operative parts of the contract issued by the party	0, n	list of *cel-core:*Issuer relations	list of *mco-core:*issuedBy relations
actionIdref[]	**actionsIsSubject** The acts that the party may / must / must not / did execute, specified in a Deontic	0, n	*cel-core:*Act and *cel-core:*Subject relation within a *cel-core:*DeonticStructuredClause	*mco-core:*actedBy for a *mco-core:*GenericAction in a *mco-core:* DeonticExpression

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getName()**	string
void	**getDetails()**	map (string, string)
string	**getDetailBy()**	string
void	**getMetadata()**	map (string, string)
string	**getMetadataBy()**	string
void	**getAddress()**	string

Methods		
Parameters	**Method and Description**	**Return**
void	**getDeonticsIssued()**	deonticIdref[]
void	**getActionsIsSubject()**	actionIdref[]
string	**Party()** This method constructs a new object and gets as input only the identifier	void
string, string	**Party()** This method constructs a new object and gets as input all the required fields	void
string	**setIdentifier()**	void
string	**setName()**	void
map (string, string)	**setDetails()**	void
string, string	**addDetails()**	void
map (string, string)	**setMetadata()**	void
string, string	**addMetadata()**	void
string	**setAddress()**	void
deonticIdref[]	**setDeonticsIssued()**	void
deonticIdref	**addDeonticsIssued()**	void
actionIdref[]	**setActionsIsSubject()**	void
actionIdref	**addActionsIsSubject()**	void

8.2.2 Person/User

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
PersonUser	Abstract, sub-class of Party		*cel-core:*Person	*mco-core:*User
Fields				
Type	**Field and Description**	**Occ.**		
string	**signature** Contract binding signature	0, 1	*dsig:*Signature	*mco-core:*Signature

Methods		
Parameters	**Method and Description**	**Return**
void	**getSignature()**	string
string	**PersonUser()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, string	**PersonUser()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
string	**setSignature()**	void

8.2.3 CELPerson

Class			CEL	MCO
Name	**Type and Hierarchy**			
CELPerson	Concrete, sub-class of PersonUser		*cel-core*:Person *cel-core*:Signatory	/
Fields				
Type	**Field and Description**	**Occ.**		
/	/	/	/	/

Methods		
Parameters	**Method and Description**	**Return**
string	**CELPerson()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, string	**CELPerson()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void

8.2.4 MCOUser

Class			CEL	MCO
Name	**Type and Hierarchy**			
User	Concrete, sub-class of Person		/	*mco-core*:User
Fields				
Type	**Field and Description**	**Occ.**		
enum (role)	**role** The user role. The enum value must be: 0 = User (simple) 1 = Creator 2 = Adaptor 3 = Instantiator 4 = Producer 5 = Distributor 6 = EndUser 7 = Collective	1	/	*mvco*:Creator *mvco*:Adaptor *mvco*:Instantiator *mvco*:Producer *mvco*:Distributor *mvco*:EndUser *mvco*:Collective
string	**socialTag**	0, 1	/	*mvco*:hasSocialTag
personuserIdref[]	**actOnBehalfOf**	0, n	/	*mvco*:actOnBehalfOf
personuserIdref[]	**belongsToCollective**	0, n	/	*mvco*:belongsTo *mvco*:Collective
ipentityIdref[]	**isRightsOwnerOf**	0, n	/	*mvco*:isRightsOwnerOf

Methods		
Parameters	**Method and Description**	**Return**
void	**getRole()**	enum (role)
void	**getSocialTag()**	string
void	**getActOnBehalfOf()**	personuserIdref[]
void	**getBelongsToCollective()**	personuserIdref[]
void	**getIsRightsOwnerOf()**	ipentityIdref[]
string	**MCOUser()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, string, enum (role)	**MCOUser()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
enum (role)	**setRole()**	void
string	**setSocialTag()**	void
personuserIdref[]	**setActOnBehalfOf()**	void
personuserIdref	**addActOnBehalfOf()**	void
personuserIdref[]	**setBelongsToCollective()**	void
personuserIdref	**addBelongsToCollective()**	void
ipentityIdref[]	**setIsRightsOwnerOf()**	void
ipentityIdref	**addIsRightsOwnerOf()**	void

8.2.5 Organization

Class			CEL	MCO
Name	**Type and Hierarchy**			
Organization	Concrete, sub-class of Party		*cel-core:* Organization	*mco-core:* Organization
Fields				
Type	**Field and Description**	**Occ.**		
personuserIdref	**signatory** A signatory person optionally given for an Organization	0, 1	cel-core:Signatory	*mco-core:* hasSignatory

Methods		
Parameters	**Method and Description**	**Return**
void	**getSignatory()**	personuserIdref
string	**Organization()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, string	**Organization()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
personuserIdref	**setSignatory()**	void

8.3 Deontic

8.3.1 DeonticStructuredClause/DeonticExpression

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Deontic	Abstract, sub-class of Encrypt-able		*cel-core:*DeonticStruct uredClause	*mco-core:* DeonticExpression
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the deontic	1	*cel-core:*DeonticStruct uredClause id *(attribute)*	*rdf:about*
enum (type)	**type** 0 = Statement/Simple 1 = Permission 2 = Obligation 3 = Prohibition	1	*cel-core:* Statement, *cel-core:* Permission, *cel-core:* Obligation, *cel-core:* Prohibition	*mco-core:* DeonticExpression, *mco-core:* Permission, *mco-core:* Obligation, *mco-core:* Prohibition
textIdref[]	**textClauses** The text clauses that represents	0, n	*cel-core:*DeonticStruct uredClause idrefs *(attribute)*	*mco-core:*implements
map (string, string)	**metadata** For giving information about the contract itself.	0, n	*cel-core:* *Metadata* Dublin Core (ISO 15836) or others	Dublin Core (ISO 15836) or others
actionIdref	**act** Specifies the right that is permitted / obligated / prohibited	1	*cel-core:*Act	*mco-core:*obligatesAction *mco-core:*permitsAction *mco-core:*forbidsAction
partyIdref	**actedBySubject** Party to which the deontic clause applies	1	*cel-core:*Act and *cel-core:*Subject relation within a *cel-core:*DeonticStructuredClause	*mco-core:*actedBy for a *mco-core:*GenericAction in a *mco-core:* DeonticExpression
objectIdref[]	**actObjects** Resources against which the deontic expression will apply	0, n	*cel-core:*Object	*mco-core:*actedOver *mvco:*Action *mco-core:* IPEntity *mco-core:*Service
itemIdref[]	**resultantObject** Resource resultant of applying the act over the actObjects	0, n	*cel-core:*ResultantObject	inverse of *mvco:* ResultFrom in the relation between *mvco:*Action and *mvco:* IPEntity
factIdref[]	**constraints**	0, n	*cel-core:*Constraint	*mco-core:*hasRequired
partyIdref	**issuer**	0, 1	*cel-core:*Issuer	*mco-core:*issuedBy

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getType()**	enum (type)
void	**getTextClauses()**	textIdref[]
void	**getMetadata()**	map (string, string)
string	**getMetadataBy()**	string
void	**getAct()**	actionIdref
void	**getActedBySubject()**	partyIdref
void	**getActObjects()**	objectIdref[]
void	**getResultantObject()**	itemIdref[]
void	**getConstraints()**	factIdref[]
void	**getIssuer()**	partyIdref
string	**Deontic()** This method constructs a new object and gets as input only the identifier.	void
string, enum (type), actionIdref, partyIdref	**Deontic()** This method constructs a new object and gets as input all the required fields.	void
string	**setIdentifier()**	void
enum (type)	**setType()**	void
textIdref[]	**setTextClauses()**	void
textIdref	**addTextClauses()**	void
map (string, string)	**setMetadata()**	void
string, string	**addMetadata()**	void
actionIdref	**setAct()**	void
partyIdref	**setActedBySubject()**	void
objectIdref[]	**setActObjects()**	void
objectIdref	**addActObjects()**	void
itemIdref[]	**setRetultantObject()**	void
itemIdref	**addRetultantObject()**	void
factIdref[]	**setConstraints()**	void
factIdref	**addConstraints()**	void
partyIdref	**setIssuer()**	void

8.3.2 TextClause

Class			CEL	MCO
Name	**Type and Hierarchy**			
TextClause	Concrete		cel-core:TextClause	mco-core: TextualClause
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the party	1	cel-core:TextClause id (attribute)	rdf:about

Class			CEL	MCO
Name	Type and Hierarchy			
textIdref[]	**innerTextClauses** TextClauses objects considered within this one	0, n	cel-core:TextClause	/
map(textIdref, string)	**paragraphs** Containing the actual text	0, n	cel-core: TextParagraph	/
encrypted-Idref[]	**encryptedParagraphs** Encrypted representation of a paragraph	0, 1	cel-core:EncryptedTextParagraph	/
string	**text** Optional representation of the clause as a whole text instead of paragraph subdivision	0, 1	/	mco-core:Text

Methods		
Parameters	Method and Description	Return
void	**getIdentifier()**	string
void	**getInnerTextClauses()**	textIdref[]
void	**getParagraphs()**	map (textIdref, string)
string	**getParagraphsBy()**	textIdref
void	**getEncryptedParagraphs()**	encryptedIdref[]
void	**getText()**	string
string	**setTextClause()** This method constructs a new object and gets as input only the identifier.	void
string	**setIdentifier()**	void
textIdref[]	**setInnerTextClauses()**	void
textIdref	**addInnerTextClauses()**	void
map(textIdref, string)	**setParagraphs()**	void
textIdref, string	**addParagraphs()**	void
encryptedIdref[]	**setEncryptedParagraphs()**	void
encryptedIdref	**addEncryptedParagraphs()**	void
string	**setText()**	void

8.3.3 CELDeonticStructuredBlock

Class			CEL	MCO
Name	Type and Hierarchy			
CELDeontic-Structured-Block	Concrete, sub-class of Encryptable		cel-core:DeonticStructuredBlock	/
Fields				
Type	Field and Description	Occ.		
string	**identifier** Uniquely identifies the party	1	cel-core:DeonticStructuredBlock id (attribute)	/

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
textIdref[]	**textClauses** The text clauses that represent this block	0, n	cel-core:DeonticStructuredBlock idrefs (attribute)	/
deonticStructuredBlockIdref[]	**innerDeonticStructuredBlocks** DeonticStructuredBlock objects considered within this one	0, n	cel-core:DeonticStructuredBlock	/
deonticIdref[]	**deontics** Deontics within a block	0, n	cel-core:DeonticStructuredClause	/

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getTextClauses()**	textIdref[]
void	**getInnerDeonticStructuredBlocks()**	deonticStructuredBlockIdref[]
void	**getDeontics()**	deonticIdref[]
string	**CELDeonticStructureBlock()** This method constructs a new object and gets as input only the identifier.	void
string	**setIdentifier()**	void
textIdref[]	**setTextClauses()**	void
textIdref	**addTextClauses()**	void
deonticStructuredBlockIdref[]	**setInnerDeonticStructuredBlocks()**	void
deonticStructuredBlockIdref	**addInnerDeonticStructuredBlocks()**	void
deonticIdref[]	**setDeontics()**	void
deonticIdref	**addDeontics()**	void

8.3.4 CELDeonticStructuredClause

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
CELDeonticStructuredClause	Concrete, sub-class of Deontic		*cel-core:*DeonticStructuredClause	/
Fields				
Type	**Field and Description**	**Occ.**		
string	**number**	0, 1	*cel-core:*DeonticStructuredClause number (attribute)	/
string[]	**context** Contextual information of any type that can be added to a deontic structured clause	0, n	*cel-core:*Context	/

Class			CEL	MCO
Name	Type and Hierarchy			
map(condition-Idref, CELCondition)	**preCondition** Pre-conditions of the deontic clause	0, n	*cel-core:*PreCondition	/
CELCondition	**postCondition** Post-condition of the deontic clause	0, 1	*cel-core:* PostCondition	/

Methods		
Parameters	**Method and Description**	**Return**
void	**getNumber()**	string
void	**getContext()**	string[]
void	**getPreCondition()**	map(conditionI-dref,CELCondition)
conditionIdref	**getPreConditionBy()**	CELCondition
void	**getPostCondition()**	CELCondition
string	**CELDeonticStructuredClause()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, enum (type), actionIdref, party-Idref	**CELDeonticStructuredClause()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass construc-tor.	void
string	**setNumber()**	void
string[]	**setContext()**	void
string	**addContext()**	void
map(conditionI-dref,CELCondition)	**setPreCondition()**	void
conditionIdref,CEL-Condition	**addPreCondition()**	void
CELCondition	**setPostCondition()**	void

8.3.5 CELCondition

Class			CEL	MCO
Name	**Type and Hierarchy**			
CELCondition	Concrete		*cel-core:* PreCondition *cel -core:*PostCondition	/
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the condition	1	*cel-core:* PreCondition *cel-core:* PostCondition id *(attribute)*	/

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
enum (actionStatus)	**actionStatus** Indicates the status of the action in the deontic clause to which the condition refers. The enum value must be: 0 = ActionStarted 1 = ActionDone	0, 1	actionStatus *(attribute)*	/
string	**withDelay** The elapsed time after which the deontic clause has to be considered valid	0, 1	withDelay *(attribute)*	/
string	**validity** the time of validity of the deontic clause	0, 1	validity *(attribute)*	/

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getActionStatus()**	enum (actionStatus)
void	**getWithDelay()**	string
void	**getValidity()**	string
string	**CELCondition()** This method constructs a new object and gets as input only the identifier.	void
string	**setIdentifier()**	void
enum (actionStatus)	**setActionStatus()**	void
string	**setWithDelay()**	void
string	**setValidity()**	void

8.3.6 MCODeonticExpression

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
MCODeonticExpression	Concrete, sub-class of Deontic		/	*mco-core:* DeonticExpression
Fields				
Type	**Field and Description**	**Occ.**		
/	/	/	/	/

Methods		
Parameters	**Method and Description**	**Return**
void	**getRequiredFacts()** This method calls the super-method getConstraints().	map(factIdref, Fact)
string	**MCODeonticExpression()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void

Methods		
Parameters	**Method and Description**	**Return**
string, enum (type), actionIdref, partyIdref	**MCODeonticExpression()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
map(factIdref, Fact)	**setRequiredFacts()** This method calls the super-method setConstraints().	void
factIdref, Fact	**addRequiredFacts()** This method calls the super-method addConstraints().	void

8.3.7 Permission

Class			CEL	MCO
Name	**Type and Hierarchy**			
Permission	Abstract, sub-class of Deontic		*cel-ipre:*Permission	*mvco:*Permission
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 1 = Permission (super-class field override)	1	*cel-core:* Permission	*mco-core:* Permission
float	**percentage** Indicates when the permission is shared with other parties	0, 1	*cel-core:*Permission percentage *(attribute)*	*mco-ipre:*hasPercentage
float	**incomePercentage** Indicates when the income of the exploitation of the permission has to be shared	0, 1	*cel-core:*Permission incomePercentage *(attribute)*	*mco-ipre:* hasIncomePercentage
boolean	**isExclusive** Indicates if this exploitation might be granted by the issuer to multiple licensees in the same context or not	0, 1	*cel-core:*Permission isExclusive *(attribute)*	*mco-ipre:*isExclusive
boolean	**hasSublicenseRight** Indicates if it is possible to sublicense a granted right	0, 1	*cel-core:*Permission sublicenseRight *(attribute)*	*mco-ipre:* hasSublicenseRight

Methods		
Parameters	**Method and Description**	**Return**
void	**getPercentage()**	float
void	**getIncomePercentage()**	float
void	**getIsExclusive()**	boolean
void	**getHasSublicenseRight()**	boolean
string	**Permission()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void

Methods		
Parameters	**Method and Description**	**Return**
string, actionIdref, partyIdref	**Permission()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
float	**setPercentage()**	void
float	**setIncomePercentage()**	void
boolean	**setIsExclusive()**	void
boolean	**setHasSublicenseRight()**	void

8.3.8 CELPermission

Class			CEL	MCO
Name	**Type and Hierarchy**			
Permission	Concrete, sub-class of Permission, sub-class of CELDeonticStructuredClause		*cel-ipre:*Permission	/
Fields				
Type	**Field and Description**	**Occ.**		
/	/	/	/	/

Methods		
Parameters	**Method and Description**	**Return**
string	**CELPermission()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, actionIdref, partyIdref	**CELPermission()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void

8.3.9 MCOPermission

Class			CEL	MCO
Name	**Type and Hierarchy**			
MCOPermission	Concrete, sub-class of Permission, sub-class of MCOPermission		/	*mvco:*Permission
Fields				
Type	**Field and Description**	**Occ.**		
/	/	/	/	/

Methods		
Parameters	**Method and Description**	**Return**
string	**MCOPermission()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void

Methods		
Parameters	**Method and Description**	**Return**
string, actionIdref, partyIdref	**MCOPermission()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void

8.4 Action

8.4.1 Act/GenericAction/Action

Class			CEL	MCO
Name	**Type and Hierarchy**			
Action	Concrete		*cel-core*:Act	*mco-core:* GenericAction *mvco:*Action
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the action	1	*cel-core:Act* id *(attribute)*	*rdf:about*
enum (type)	**type** 0 = Action (simple) 1 = CreateWork 2 = Distribute 3 = EndUserAction 4 = ModifyCopy 5 = Dub 6 = MoveContent 7 = Render 8 = MakeAdaptation 9 = MakeCopy (Duplicate)	1	*cel-core* *cel-ipre* *cel-pane* *cel-rele*	*mco-core* *mco-ipre* *mco-pane* *mco-rele* *mvco*

Class			CEL	MCO
Name	Type and Hierarchy			
	10 = MakeAdaptationInstanceCopy 11 = MakeAdaptationManifestationCopy 12 = MakeWorkInstanceCopy 13 = MakeWorkManifestationCopy 14 = MakeInstance (Fixate) 15 = MakeAdaptationInstance 16 = MakeWorkInstance 17 = MakeManifestation 18 = MakeAdaptationManifestation 19 = MakeWorkManifestation 20 = Produce 21 = PublicCommunication 22 = Broadcast 23 = Download 24 = Stream 25 = CommunicationToThePublic 26 = PublicPerformance 27 = Synchronise 28 = GenericAction 29 = Reuse 30 = ExploitIPRights 31= Transform 32 = Translate 33 = MakeCutAndEdit 34 = MakeExcerpt 35 = MakeRadioProduct 36 = Remix 37 = CreativeTransform 38 = Novelization 39 = Prequel 38 = Sequel 39 = Remake 40 = Spinoff			

Class			CEL	MCO
Name	Type and Hierarchy			
	41 = RelAct 42 = Issue 43 = Obtain 44 = PossessProperty 45 = Revoke 46 = Rel-mx-Act 47 = Rel-sx-Act 48 = Adapt 49 = Delete 50 = Diminish 51 = Embed 52 = Enhance 53 = Enlarge 54 = Execute 55 = Install 56 = Modify 57 = Move 58 = Play 59 = Print 60 = Reduce 61 = Uninstall 62 = RightUri 63 = Trade 64 = Consume 65 = Match 66 = Provide 67 = Payment 68 = Notify 69 = UserDefinedAction			
actionIdref[]	**impliesAlso** Other actions implied	0, n	/	*mvco:*impliesAlso
personuserIdref[]	**rightGivenBy** The Persons/Users that provide the right to perform the action	0, n	/	*mvco:*rightGivenBy

Methods		
Parameters	Method and Description	Return
void	**getIdentifier()**	string
void	**getType()**	enum (type)

Methods		
Parameters	**Method and Description**	**Return**
void	**getImpliesAlso()**	actionIdref[]
void	**getRightGivenBy()**	personuserIdref[]
string	**Action()** This method constructs a new object and gets as input only the identifier.	void
string, enum (type)	**Action()** This method constructs a new object and gets as input all the required fields.	void
string	**setIdentifier()**	void
enum (type)	**setType()**	void
actionIdref[]	**setImpliesAlso()**	void
actionIdref	**addImpliesAlso()**	void
personuserIdref[]	**getRightGivenBy()**	void
personuserIdref	**addRightGivenBy()**	void

8.4.2 Trade

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Trade	Concrete, sub-class of Action		/	*mco-core:*Trade
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 63 = Trade (super-class field override)	1	/	*mco-core:* Trade
deonticIdref	**sellsDeontic**	1	/	*mco-ipre:* sellsDeontic

Methods		
Parameters	**Method and Description**	**Return**
void	**getSellsDeontic()**	deonticIdref
string	**Trade()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, deonticIdref	**Trade()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
deonticIdref	**setSellsDeontic()**	void

8.4.3 Provide

Class		**CEL**	**MCO**
Name	**Type and Hierarchy**		
Provide	Concrete, sub-class of Action	*cel-core:*Provide	*mco-core:*Provide

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 66 = Provide (super-class field override)	1	/	*mco-core:* Provide
boolean	**isOnLoan**	0, 1	*cel-core:*Provide isOnLoan (attrib-ute)	*mco-core:*isOnLoan
partyRef[]	**recipients**	0, n	*cel-core:*Provide recipients (attribute)	*mco-core:* hasRecipient

Methods		
Parameters	**Method and Description**	**Return**
void	**getIsOnLoan()**	boolean
void	**getRecipients()**	partyRef[]
string	**Provide()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
boolean	**setIsOnLoan()**	void
partyRef[]	**setRecipients()**	void
partyRef	**addRecipients()**	void

8.4.4 Payment

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Payment	Concrete, sub-class of Action		*cel-pane:*Payment	*mco-pane:*Payment
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 67 = Payment (super-class field override)	1	*cel-pane:*Payment	*mco-pane:* Payment
partyIdref[]	**beneficiaries**	1, n	*cel-pane:Beneficiary*	*mco-pane:*hasBeneficiary
actionIdref[]	**incomeSources**	0, n	*cel-pane:* IncomeSource	*mco-pane:*hasIncomeSource
float	**amount**	0, 1	*cel-pane:*Payment amount (attribute)	*mco-pane:*hasAmount
string	**currency**	0, 1	*cel-pane:*Payment currency (attribute)	*mco-pane:*hasCurrency

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
float	**incomePercentage**	0, 1	*cel-pane:*Payment incomePercentage (attribute)	*mco-pane:* hasIncomePercentage

Methods		
Parameters	**Method and Description**	**Return**
void	**getBeneficiaries()**	partyIdref[]
void	**getIncomeSources()**	actionIdref[]
void	**getAmount()**	float
void	**getCurrency()**	string
void	**getIncomePercentage()**	float
string	**Payment()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, partyIdref[]	**Payment()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass con-structor.	void
partyIdref[]	**setBeneficiaries()**	void
partyIdref	**addBeneficiaries()**	void
actionIdref[]	**setIncomeSources()**	void
actionIdref	**addIncomeSources()**	void
float	**setAmount()**	void
string	**setCurrency()**	void
float	**setIncomePercentage()**	void

8.4.5 Notify

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Notify	Concrete, sub-class of Action		*cel-pane:*Notify	*mco-pane:*Notify
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 68 = Notify (super-class field override)	1	*cel-pane:*Notify	*mco-pane:* Notify
partyIdref[]	**recipients**	1, n	*cel-pane:Recipient*	*mco-pane:* hasRecipient
actionIdref[]	**isAbout**	0, n	*cel-pane:*About	*mco-pane:*isAbout

Methods		
Parameters	**Method and Description**	**Return**
void	**getRecipients()**	partyIdref[]

Methods		
Parameters	**Method and Description**	**Return**
void	**getIsAbout()**	actionIdref[]
string	**Notify()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, partyIdref[]	**Notify()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
partyIdref[]	**setRecipients()**	void
partyIdref	**addRecipients()**	void
actionIdref[]	**setIsAbout()**	void
actionIdref	**addIsAbout()**	void

8.4.6 UserDefinedAction

Class			CEL	MCO
Name	**Type and Hierarchy**			
UserDefinedAction	Concrete, sub-class of Action		*cel-core:* UserDefinedAction	/
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 69 = UserDefinedAction (super-class field override)	1	*cel-core:* UserDefinedAction	/
string	**href**	0, 1	*cel-core:* UserDefinedAction href (attribute)	/
string	**name**	1	*cel-core:*Name	/
string	**standardReference**	0, 1	*cel-core:* StandardReference	/
string	**definition**	0, 1	*cel-core:*Definition	/

Methods		
Parameters	**Method and Description**	**Return**
void	**getHref()**	string
void	**getName()**	string
void	**getStandardReference()**	string
void	**getDefinition()**	string
string	**UserDefinedAction()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, string	**UserDefinedAction()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void

Methods		
Parameters	**Method and Description**	**Return**
string	**setHref()**	void
string	**setName()**	void
string	**setStandardReference()**	void
string	**setDefinition()**	void

8.5 Object

8.5.1 Object

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Object	Abstract		*cel-core:*Object	/
Fields				
Type	**Field and Description**	**Occ.**		
/	/	/	/	/

Methods		
Parameters	**Method and Description**	**Return**
/	/	/

8.5.2 Item

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Item	Concrete, sub-class of Object		*cel-core:*Item	/
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the item	0, 1	*dii:*Identifier	dii:Identifier
string[]	**relatedIdentifiers**	0, n	*dii:RelatedIdentifier*	dii:RelatedIdentifier
string	name	0, 1	cel-core:Item name (attribute)	/

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getRelatedIdentifiers()**	string[]
void	getName()	string
string	**Item()** This method constructs a new object and gets as input only the identifier.	void
string	**setIdentifier()**	void
string[]	**setRelatedIdentifiers()**	void

Methods		
Parameters	**Method and Description**	**Return**
string	**addRelatedIdentifiers()**	void

8.5.3 IPEntity

Class			CEL	MCO
Name	**Type and Hierarchy**			
IPEntity	Concrete, sub-class of Item		/	*mvco:*IPEntity
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 0 = IPEntity (simple) 1 = Adaptation 2 = Excerpt 3 = Copy 4 =AdaptationInstanceCopy 5 = AdaptationManifestationCopy 6 = WorkInstanceCopy 7 = WorkManifestationCopy 8 = Instance 9 = AdaptationInstance 10 = WorkInstance 11 = Manifestation 12 = AdaptationManifestation 13 = WorkManifestation 14 = Product 15 = Work 16 = Event 17 = Segment	1	/	*mvco* *mco-core:*Event *avco:*Segment
map (string, string)	**metadata** For giving information about the contract itself.	0, n	*cel-core:*Metadata Dublin Core (ISO 15836) or others	Dublin Core (ISO 15836) or others
string	**socialTag**	0, 1	/	*mvco:*hasSocialTag
boolean	**isDigital**	0, 1	/	*avco:*hasSocialTag
personuserIdref[]	**rightsOwners**	0, n	/	*mvco:*hasRightsOwner
ipentityIdref[]	**isMadeUpOf**	0, n	/	*mvco:*isMadeUpOf
actionIdref[]	**resultedFrom**	0, n	/	*mvco:*resultedFrom
boolean	**isAudio**	0, 1	/	*avco:*isAudio
ipentityIdref[]	**segments**	0, n	/	*avco:*hasSegment
trackIdref[]	**tracks**	0, n	/	*avco:*hasTrack
intervalIdref[]	**intervals**	0, n	/	*avco:*interval

Methods		
Parameters	**Method and Description**	**Return**
void	**getType()**	enum (type)
void	**getMetadata()**	map (string, string)
string	**getMetadataBy()**	string
void	**getSocialTag()**	string
void	**getIsDigital()**	boolean
void	**getRightsOwners()**	personuserIdref[]
void	**getIsMadeUpOf()**	ipentityIdref[]
void	**getResultedFrom()**	actionIdref[]
void	**getIsAudio()**	boolean
void	**getSegments()**	ipentityIdref[]
void	**getTracks()**	trackIdref[]
void	**getIntervals()**	intervalIdref[]
string	**IPEntity()** This method constructs a new object and gets as input only the identifier.	void
string, enum (type)	**IPEntity()** This method constructs a new object and gets as input all the required fields.	void
enum (type)	**setType()**	void
map (string, string)	**setMetadata()**	void
string, string	**addMetadata()**	void
string	**setSocialTag()**	void
boolean	**setIsDigital()**	void
personuserIdref[]	**setRightsOwners()**	void
personuserIdref	**addRightsOwners()**	void
ipentityIdref[]	**setIsMadeUpOf()**	void
ipentityIdref	**addIsMadeUpOf()**	void
actionIdref[]	**setResultedFrom()**	void
actionIdref	**addResultedFrom()**	void
boolean	**setIsAudio()**	void
ipentityIdref[]	**setSegments()**	void
ipentityIdref	**addSegments()**	void
trackIdref[]	**setTracks()**	void
trackIdref	**addTracks()**	void
intervalIdref[]	**setIntervals()**	void
intervalIdref	**addIntervals()**	void

8.5.4 Event

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Event	Concrete, sub-class of IPEntity		*cel-core:*Event	*mco-core:*Event
Fields				
Type	**Field and Description**	**Occ.**		

Class			CEL	MCO
Name	**Type and Hierarchy**			
enum (type)	**type** 16 = Event (super-class field override)	1	*cel-core:*Event	*mco-core:*Event

Methods		
Parameters	**Method and Description**	**Return**
string	**Event()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void

8.5.5 Segment

Class			CEL	MCO
Name	**Type and Hierarchy**			
Segment	Concrete, sub-class of IPEntity		/	*avco:*Segment
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 17 = Segment (super-class field override)	1	/	*avco:*Segment
ipentityIdref	**segmentOf**	0, 1	/	*avco:*segmentOf
ipentityIdref[]	**contains**	0, n	/	*avco:*contain
trackIdref[]	**onTrack**	0, n	/	*avco:*onTrack

Methods		
Parameters	**Method and Description**	**Return**
void	**getSegmentOf()**	ipentityIdref
void	**getContains()**	ipentityIdref[]
void	**getOnTrack()**	trackIdref[]
string	**Segment()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
ipentityIdref	**setSegmentOf()**	void
ipentityIdref[]	**setContains()**	void
ipentityIdref	**addContains()**	void
trackIdref[]	**setOnTrack()**	void
trackIdref	**addOnTrack()**	void

8.5.6 Service

Class		CEL	MCO
Name	**Type and Hierarchy**		
Service	Concrete, sub-class of Object	*cel-core:*Service	*mco-core:*Service

Class			CEL	MCO
Name	**Type and Hierarchy**			
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the service	1	/	*rdf:*about
enum (type)	**type** 0 = Service (simple) 1 = Authenticate 2 = Deliver 3 = Describe 4 = Identify 5 = InteractWith 6 = Package 7 = Post 8 = Present 9 = Process 10 = Store 11 = Verify	1	*cel-core:*Service	*mco-core:*Service

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getType()**	enum (type)
string	**Service()** This method constructs a new object and gets as input only the identifier.	void
string, enum (type)	**Service()** This method constructs a new object and gets as input all the required fields.	void
string	**setIdentifier()**	void
enum	**setType()**	void

8.5.7 SubjectWrapperObject

Class			CEL	MCO
Name	**Type and Hierarchy**			
SubjectWrapperObject	Concrete, sub-class of Object		*cel-core:*Subject	*mco-core:*Party
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the SubjectWrapperObject	1	/	/

Class			CEL	MCO
Name	**Type and Hierarchy**			
partyIdref	**partyRefersTo** The party referred as object	1	*cel-core:*Subject	*mco-core:*Party

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getPartyRefersTo()**	partyIdref
string	**SubjectWrapperObject()** This method constructs a new object and gets as input only the identifier.	void
string, partyIdref	**SubjectWrapperObject()** This method constructs a new object and gets as input all the required fields.	void
string	**setIdentifier()**	void
partyIdref	**setPartyRefersTo()**	void

8.5.8 Track

Class			CEL	MCO
Name	**Type and Hierarchy**			
Track	Concrete, sub-class of Object		/	*avco:*Track
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the track	1	/	*rdf:*about
ulong	**trackNumber**	1	/	*avco:*trackNumber

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getTrackNumber()**	ulong
string	**Track()** This method constructs a new object and gets as input only the identifier.	void
string, ulong	**Track()** This method constructs a new object and gets as input all the required fields.	void
string	**setIdentifier()**	void
ulong	**setTrackNumber()**	void

8.5.9 Interval

Class			CEL	MCO
Name	**Type and Hierarchy**			
Interval	Concrete, sub-class of Object		/	*avco:*Interval
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the interval	1	/	*rdf:*about
string	**start**	1	/	*avco:*start
string	**end**	1	/	*avco:*end
string	**duration**	1	/	*avco:*duration
string	**onTimeline**	0, 1	/	*avco:*onTimeline *avco:*Timeline

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getStart()**	string
void	**getEnd()**	string
void	**getDuration()**	string
void	**getOnTimeline()**	string
string	**Interval()** This method constructs a new object and gets as input only the identifier.	void
string, string, string, string	**Interval()** This method constructs a new object and gets as input all the required fields.	void
string	**setIdentifier()**	void
string	**setStart()**	void
string	**setEnd()**	void
string	**setDuration()**	void
string	**setOnTimeline()**	void

8.6 Fact

8.6.1 Constraint/Fact

Class			CEL	MCO
Name	**Type and Hierarchy**			
Fact	Concrete		*cel-core:*Constraint, *cel-core:* Fact	*mvco:*Fact
Fields				
Type	**Field and Description**	**Occ.**		
string	**identifier** Uniquely identifies the interval	1	/	*rdf:*about

Class			CEL	MCO
Name	Type and Hierarchy			
enum (type)	**type** 0 = Fact (simple) 1 = FactCoposition 2 = ActionEventFact 3 = TogetherWith 4 = ExploitationCondition (simple) 5 = AccessPolicy 6 = CopyrightExceptionFact 7 = DeliveryModality 8 = Device 9 = IPEntityContext 10 = Language 11 = Length 12 = MaterialFormat 13 = Means 14 = Runs 15 = ServiceAccessPolicy 16 = ServiceChannelContext 17 = SpatialContext 18 = TemporalContext 19 = UserTimeAccess 20 = UserDefinedFact 21 = RelCondition (Simple) 22 = AllConditions 23 = CallForConditions 24 = Destination 25 = DiCriteria 26 = DIPartOf 27 = ExerciseLimit 28 = ExerciseMechanism	1	*cel-core:*Fact *cel-ipre:*Exploitatio nCondition cel-rele	*mvco:Fact* *mco-ipre:*Exploitatio nCondition

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
	29 = ExistsRight			
	30 = FeeFlat			
	31 = FeeMetered			
	32 = FeePerInterval			
	33 = FeePerUse			
	34 = FeePerUsePrePay			
	35 = Fulfiller			
	36 = Helper			
	37 = IsMarked			
	38 = Mark			
	39 = PrerequisiteRight			
	40 = ProhibitedAttrib-uteChanges			
	41 = ResourceSignedBy			
	42 = RevocationFreshness			
	43 = SeekApproval			
	44 = Source			
	45 = Territory			
	46 = TrackQuery			
	47 = TrackReport			
	48 = Transaction			
	49 = TransferControl			
	50 = ValidityInterval			
	51 = ValidityIntervalFloating			
	52 = ValidityInterval-StartsNow			
	53 = ValidityTimeMetered			
	54 = ValidityTimePeriodic			
boolean	**isTrue**	0, 1	/	*mvco:*isTrue

Methods		
Parameters	**Method and Description**	**Return**
void	**getIdentifier()**	string
void	**getType()**	enum (type)
void	**getIsTrue()**	boolean
string	**Fact()** This method constructs a new object and gets as input only the identifier.	void
string, enum (type)	**Fact()** This method constructs a new object and gets as input all the required fields.	void

Methods		
Parameters	**Method and Description**	**Return**
string	**setIdentifier()**	void
enum (type)	**setType()**	void
boolean	**setIsTrue()**	void

8.6.2 FactComposition

Class				CEL	MCO
Name	**Type and Hierarchy**				
FactComposition	Concrete, sub-class of Fact			*cel-core:*FactNegation *cel-core:* FactIntersection *cel-core:*FactUnion	*mco-core:* FactComposition
Fields					
Type	**Field and Description**	**Occ.**			
enum (type)	**type** 1 = FactComposition (super-class field override)	1		/	*mco-core: FactComposition*
enum (compositionType)	**compositionType** 0 = Negation 1 = Union 2 = Intersection	1		*cel-core:*FactNegation *cel-core:* FactIntersection *cel-core:*FactUnion	*mco-core:*FactNegation *mco-core:* FactIntersection *mco-core:*FactUnion
factIdref[]	**composedFacts**	1..n		/	*mco-core:*hasFact

Methods		
Parameters	**Method and Description**	**Return**
void	**getCompositionType()**	enum(compositionType)
void	**getComposedFacts()**	factIdref[]
string	**FactComposition()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, enum(compositionType), factIdref[]	**FactComposition()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
enum(compositionType)	**setCompositionType()**	void
factIdref[]	**setComposedFacts()**	void
factIdref	**addComposedFacts()**	void

8.6.3 ActionEventFact

Class			CEL	MCO
Name	**Type and Hierarchy**			
ActionEventFact	Concrete, sub-class of Fact		*cel-core:* ActionEventFact	*mco-core:* ActionEventFact
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 2 = ActionEventFact (super-class field override)	1	*cel-core:* ActionEventFact	*mco-core:* ActionEventFact
string	**validity**	0, 1	*cel-core:* ActionEventFact validity (attribute)	*mco-ipre:*hasValidity
string	**withDelay**	0, 1	*cel-core:* ActionEventFact withDelay (attribute)	*mco-ipre:*withDelay
enum (status)	**status** Indicates the status of the action or the event to which the fact refers. The enum value must be: 0 = Started 1 = Done	1	*cel-core:* ActionEventFact status (attribute)	*mco-core:*Started *mco-core:*Done
ipentityIdref	**eventThatMakesTrue**	0, 1	*cel-core:* ActionEventFact ref (attribute)	*mco-core:*makesTrue
actionIdref	**actionThatMakesTrue**	0, 1	*cel-core:* ActionEventFact ref (attribute)	*mco-core:*makesTrue

Methods		
Parameters	**Method and Description**	**Return**
void	**getValidity()**	string
void	**getWithDelay()**	string
void	**getStatus()**	enum (status)
void	**getEventThatMakesTrue()**	ipentityIdref
void	**getActionThatMakesTrue()**	actionIdref
string	**ActionEventFact()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void

Methods		
Parameters	**Method and Description**	**Return**
string, enum(status)	**ActionEventFact()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
string	**setValidity()**	void
string	**setWithDelay()**	void
enum (status)	**setActionStatus()**	void
ipentityIdref	**setEventThatMakesTrue()**	void
actionIdref	**setActionThatMakesTrue()**	void

8.6.4 TogetherWith

Class			CEL	MCO
Name	**Type and Hierarchy**			
TogetherWith	Concrete, sub-class of Fact		*cel-core:* TogetherWith	*mco-core:* TogetherWith
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 3 = TogetherWith (super-class field override)	1	*cel-core:* TogetherWith	*mco-core:* TogetherWith
ipentityIdref	**withIPEntity**	0, 1	/	*mco-ipre:* withIPEntity

Methods		
Parameters	**Method and Description**	**Return**
void	**getWithIPEntity()**	ipentityIdref
string	**TogetherWith()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
ipentityIdref	**setWithIPEntity()**	void

8.6.5 AccessPolicy

Class			CEL	MCO
Name	**Type and Hierarchy**			
AccessPolicy	Concrete, sub-class of Fact		*cel-ipre:*AccessPolicy	*mco-ipre:* AccessPolicy
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 5 = AccessPolicy (super-class field override)	1	*cel-ipre:*AccessPolicy	*mco-ipre:* AccessPolicy

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
enum (restriction)	**restriction** 0 = FreeOfCharge 1 = Pay 2 = PayPerPackage 3 = PayPerView 4 = Subscription	1	*cel-ipre:* AccessPolicyType	*mco-ipre:* AccessPolicy sub-classes

Methods		
Parameters	**Method and Description**	**Return**
void	**getRestriction()**	enum (restriction)
string	**AccessPolicy()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, enum(restriction)	**AccessPolicy()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
enum (restriction)	**setRestriction()**	void

8.6.6 DeliveryModality

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
DeliveryModality	Concrete, sub-class of Fact		*cel-ipre:*DeliveryModality	*mco-ipre:* DeliveryModality
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 7 = DeliveryModality (super-class field override)	1	*cel-ipre:*DeliveryModality	*mco-ipre:* DeliveryModality
enum (restriction)	**restriction** 0 = Linear 1 = Broadcasting 2 = Webcasting 3 = NonLinear 4 = OnDemandBasis 5 = OnDemandDownload 6 = OnDemandStreaming	1	*cel-ipre:* DeliveryModalityType	*mco-ipre:* DeliveryModality sub-classes

Methods		
Parameters	**Method and Description**	**Return**
void	**getRestriction()**	enum (restriction)

Methods		
Parameters	**Method and Description**	**Return**
string	**DeliveryModality()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, enum(restriction)	**DeliveryModality()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
enum (restriction)	**setRestriction()**	void

8.6.7 Device

Class			CEL	MCO
Name	**Type and Hierarchy**			
Device	Concrete, sub-class of Fact		*cel-ipre:*Device	*mco-ipre:*Device
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 8 = Device (super-class field override)	1	*cel-ipre:*Device	*mco-ipre:*Device
enum (restriction)	**restriction** 0 = Computer 1 = MobileDevice 2 = MobileBroadcastDevice 3 = MobileTelecommunicationDevice 4 = RobotDevice 5 = StorageDevice 6 = TelevisionDevice 7 = TelevisionSet	1	*cel-ipre:*DeviceType	*mco-ipre:*Device sub-classes

Methods		
Parameters	**Method and Description**	**Return**
void	**getRestriction()**	enum (restriction)
string	**Device()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, enum(restriction)	**Device()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
enum (restriction)	**setRestriction()**	void

8.6.8 IPEntityContext

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
IPEntityContext	Concrete, sub-class of Fact		*cel-ipre:* IPEntityContext	*mco-ipre:* IPEntityContext
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 9 = IPEntityContext (super-class field override)	1	*cel-ipre:* IPEntityContext	*mco-ipre:* IPEntityContext
ipentityIdref[]	**partOf**	1	*cel-ipre:* IPEntityContext	*mco-ipre:*partOf

Methods		
Parameters	**Method and Description**	**Return**
void	**getPartOf()**	ipentityIdref[]
string	**IPEntityContext()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, ipentityIdref[]	**IPEntityContext()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
ipentityIdref[]	**setPartOf()**	void
ipentityIdref	**addPartOf()**	void

8.6.9 Language

Class			**CEL**	**MCO**
Name	**Type and Hierarchy**			
Language	Concrete, sub-class of Fact		*cel-ipre:*Language	*mco-ipre:*Language
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 10 = Language (super-class field override)	1	*cel-ipre:*Language	*mco-ipre:*Language
string[]	**languages**	1	*cel-ipre:*Language languages (attribute)	*mco-ipre:* hasLanguages

Methods		
Parameters	**Method and Description**	**Return**
void	**getLanguages()**	string[]

Methods		
Parameters	**Method and Description**	**Return**
string	**Language()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, string[]	**Language()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
string[]	**setLanguages()**	void
string	**addLanguages()**	void

8.6.10 Length

Class			CEL	MCO
Name	**Type and Hierarchy**			
Length	Concrete, sub-class of Fact		*cel-ipre:*Length	*mco-ipre:*Length
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 11 = Length (super-class field override)	1	*cel-ipre:*Length	*mco-ipre:*Length
string	**maxLength**	1	*cel-ipre:*Length maxLength (attribute)	*mco-ipre:* hasMaxLength

Methods		
Parameters	**Method and Description**	**Return**
void	**getMaxLength()**	string
string	**Length()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, string	**Length()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
string	**setMaxLength()**	void

8.6.11 MaterialFormat

Class			CEL	MCO
Name	**Type and Hierarchy**			
Material-Format	Concrete, sub-class of Fact		*cel-ipre:* MaterialFormat	*mco-ipre:* MaterialFormat
Fields				
Type	**Field and Description**	**Occ.**		

Class			CEL	MCO
Name	**Type and Hierarchy**			
enum (type)	**type** 12 = MaterialFormat (super-class field override)	1	*cel-ipre:* MaterialFormat	*mco-ipre:* MaterialFormat
string	**matchesFormatComplianceProfile**	0, 1	*cel-ipre:* MatchesFormatComplianceProfile	*mco-ipre:*matchesFormatComplianceProfile
string	**aspectRatio**	0, 1	*cel-ipre:* AspectRatio	*mco-ipre:* hasAspectRatio
string	**audioFormat**	0, 1	*cel-ipre:* AudioFormat	*mco-ipre:* hasAudioFormat
string	**format**	0, 1	*cel-ipre:*Format	*mco-ipre:*hasFormat
ulong	**maxBitrate**	0, 1	*cel-ipre:* MaxBitrate	*mco-ipre:* hasMaxBitrate
ulong	**maxLines**	0, 1	*cel-ipre:*MaxLines	*mco-ipre:* hasMaxLines
ulong	**minBitrate**	0, 1	*cel-ipre:* MinBitrate	*mco-ipre:* hasMinBitrate
ulong	**minLines**	0, 1	*cel-ipre:*MinLines	*mco-ipre:*hasMinLines
string	**videoFormat**	0, 1	*cel-ipre:* VideoFormat	*mco-ipre:* hasVideoFormat

Methods		
Parameters	**Method and Description**	**Return**
void	**getMatchesFormatComplianceProfile()**	string
void	**getAspectRatio()**	string
void	**getAudioFormat()**	string
void	**getFormat()**	string
void	**getMaxBitrate()**	ulong
void	**getMaxLines()**	ulong
void	**getMinBitrate()**	ulong
void	**getMinLines()**	ulong
void	**getVideoFormat()**	string
string	**MaterialFormat()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string	**setMatchesFormatComplianceProfile()**	void
string	**setAspectRatio()**	void
string	**setAudioFormat()**	void
string	**setFormat()**	void
ulong	**setMaxBitrate()**	void
ulong	**setMaxLines()**	void
ulong	**setMinBitrate()**	void
ulong	**setMinLines()**	void
string	**setVideoFormat()**	void

8.6.12 Means

Class			CEL	MCO
Name	**Type and Hierarchy**			
Means	Concrete, sub-class of Fact		*cel-ipre:*Means	*mco-ipre:*Means
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 13 = Means (super-class field override)	1	*cel-ipre:*Means	*mco-ipre:*Means
enum (restriction)	**restriction** 0 = Videogram 1 = TransmissionTechnology 2 = BroadcastTechnology 3 = Cable 4 = IPNetwork 5 = MobileBroadcastTechnology 6 = Satellite 7 = Terrestrial 8 = Internet 9 = MobileTechnology 10 = MobileTelecommunicationTechnology	1	*cel-ipre:*MeansType	*mco-ipre:*Means sub-classes

Methods		
Parameters	**Method and Description**	**Return**
void	**getRestriction()**	enum (restriction)
string	**Means()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, enum(restriction)	**Means()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
enum (restriction)	**setRestriction()**	void

8.6.13 Runs

Class			CEL	MCO
Name	**Type and Hierarchy**			
Runs	Concrete, sub-class of Fact		*cel-ipre:*Runs	*mco-ipre:*Runs
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 14 = Runs (super-class field override)	1	*cel-ipre:*Runs	*mco-ipre:*Runs

Class			CEL	MCO
Name	Type and Hierarchy			
ulong	**numberOfRuns**	1	*cel-ipre:*Runs numberOfRuns (attribute)	*mco-ipre:* hasNumberOfRuns
string	**validity**	0, 1	*cel-ipre:*Runs validity (attribute)	*mco-ipre:*hasValidity
ulong	**numberOfRepetitions**	0, 1	*cel-ipre:*Runs numberOfRepetitions (attribute)	*mco-ipre:*hasNumberOfRepetitions

Methods		
Parameters	Method and Description	Return
void	**getNumberOfRuns()**	ulong
void	**getValidity()**	string
void	**getNumberOfRepetitions()**	ulong
string	**Runs()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, ulong	**Runs()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
ulong	**setNumberOfRuns()**	void
string	**setValidity()**	void
ulong	**setNumberOfRepetitions()**	void

8.6.14 ServiceAccessPolicy

Class			CEL	MCO
Name	Type and Hierarchy			
ServiceAccessPolicy	Concrete, sub-class of Fact		*cel-ipre:* ServiceAccessPolicy	*mco-ipre:* ServiceAccessPolicy
Fields				
Type	Field and Description	Occ.		
enum (type)	**type** 15 = ServiceAccessPolicy (super-class field override)	1	*cel-ipre:* ServiceAccessPolicy	*mco-ipre:* ServiceAccessPolicy

Class			CEL	MCO
Name	Type and Hierarchy			
enum (restriction)	**restriction** 0 = Open 1 = Restricted 2 = Hotel 3 = PublicPerformanceHalls 4 = Transportations 5 = Airplanes 6 = BusesMetro 7 = Ships 8 = Trains	1	*cel-ipre:*ServiceAccessPolicyType	*mco-ipre:* ServiceAccessPolicy sub-classes

Methods		
Parameters	Method and Description	Return
void	**getRestriction()**	enum (restriction)
string	**ServiceAccessPolicy()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, enum(restriction)	**ServiceAccessPolicy()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
enum (restriction)	**setRestriction()**	void

8.6.15 ServiceChannelContext

Class			CEL	MCO
Name	Type and Hierarchy			
ServiceChannelContext	Concrete, sub-class of Fact		*cel-ipre:*ServiceChannelContext	*mco-ipre:*ServiceChannelContext
Fields				
Type	Field and Description	Occ.		
enum (type)	**type** 16 = ServiceChannelContext (super-class field override)	1	*cel-ipre:*ServiceChannelContext	*mco-ipre:*ServiceChannelContext
string[]	**servicesAndChannels**	0, 1	*cel-ipre:*ServiceChannelContext servicesAndChannels (attribute)	*mco-ipre:*hasServicesAndChannels

Methods		
Parameters	**Method and Description**	**Return**
void	**getServicesAndChannels()**	string[]
string	**ServiceChannelContext()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string[]	**setServicesAndChannels()**	void
string	**addServicesAndChannels()**	void

8.6.16 SpatialContext

Class			CEL	MCO
Name	**Type and Hierarchy**			
SpatialCon-text	Concrete, sub-class of Fact		*cel-ipre:* SpatialContext	*mco-ipre:* SpatialContext
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 17 = SpatialContext (super-class field override)	1	*cel-ipre:* SpatialContext	*mco-ipre:* SpatialContext
string[]	**countries**	1, n	*cel-ipre:*Country	*mco-ipre:*inCountry
string[]	**regions**	0, n	*cel-ipre:*Region	/

Methods		
Parameters	**Method and Description**	**Return**
void	**getCountries()**	string[]
void	**getRegions()**	string[]
string	**SpatialContext()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, string[]	**SpatialContext()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
string[]	**setCountries()**	void
string	**addCountries()**	void
string[]	**setRegions()**	void
string	**addRegions()**	void

8.6.17 TemporalContext

Class			CEL	MCO
Name	**Type and Hierarchy**			
Temporal-Context	Concrete, sub-class of Fact		*cel-ipre:* TemporalContext	*mco-ipre:* TemporalContext
Fields				
Type	**Field and Description**	**Occ.**		

Class			CEL	MCO
Name	Type and Hierarchy			
enum (type)	**type** 18 = TemporalContext (super-class field override)	1	*cel-ipre:* TemporalContext	*mco-ipre:* TemporalContext
string	afterDate	0, 1	*cel-ipre:* TemporalContext afterDate (attribute)	*mco-ipre:*afterDate
string	beforeDate	0, 1	*cel-ipre:* TemporalContext beforeDate (attribute)	*mco-ipre:*beforeDate

Methods		
Parameters	Method and Description	Return
void	**getAfterDate()**	string
void	**getBeforeDate()**	string
string	**TemporalContext()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string	**setAfterDate()**	void
string	**setBeforeDate()**	void

8.6.18 UserTimeAccess

Class			CEL	MCO
Name	Type and Hierarchy			
UserTime-Access	Concrete, sub-class of Fact		*cel-ipre:* UserTimeAccess	*mco-ipre:* UserTimeAccess
Fields				
Type	Field and Description	Occ.		
enum (type)	**type** 19 = UserTimeAccess (super-class field override)	1	*cel-ipre:* UserTimeAccess	*mco-ipre:* UserTimeAccess
enum (re-striction)	**restriction** 0=Unlimited 1=Limited	1	*cel-ipre:*Limited *cel-ipre:*Unlimited	*mco-ipre:*Limited *mco-ipre:*Unlimited
string	validity	0, 1	*cel-ipre:*Limited validity (attribute)	*mco-ipre:*hasValidity

Methods		
Parameters	Method and Description	Return
void	**getRestriction()**	enum (restriction)
void	**getValidity()**	string

Methods		
Parameters	**Method and Description**	**Return**
string	**UserTimeAccess()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, enum(restriction)	**UserTimeAccess()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
enum (restriction)	**setRestriction()**	void
string	**setValidity()**	void

8.6.19 UserDefinedFact

Class			CEL	MCO
Name	**Type and Hierarchy**			
UserDefinedFact	Concrete, sub-class of Fact		*cel-core:* UserDefinedFact	/
Fields				
Type	**Field and Description**	**Occ.**		
enum (type)	**type** 20 = UserDefinedAction (super-class field override)	1	*cel-core:* UserDefinedFact	/
string	**href**	0, 1	*cel-core:* UserDefinedFact href (attribute)	/
string	**name**	1	*cel-core:*Name	/
string	**standardReference**	0, 1	*cel-core:* StandardReference	/
string	**definition**	0, 1	*cel-core:*Definition	/

Methods		
Parameters	**Method and Description**	**Return**
void	**getHref()**	string
void	**getName()**	string
void	**getStandardReference()**	string
void	**getDefinition()**	string
string	**UserDefinedFact()** This method constructs a new object and gets as input only the identifier. This constructor invokes the superclass constructor.	void
string, string	**UserDefinedFact()** This method constructs a new object and gets as input all the required fields. This constructor invokes the superclass constructor.	void
string	**setHref()**	void
string	**setName()**	void
string	**setStandardReference()**	void

Methods		
Parameters	**Method and Description**	**Return**
string	**setDefinition()**	void

9 API for MPEG-21 CEL/MCO parser

This clause specifies the API for the MPEG-21 CEL/MCO parser. This API shall be used in conjunction with MPEG-21 XML and RDF media contracts (ISO/IEC 21000-19, ISO/IEC 21000-20, and ISO/IEC 21000-21).

Methods		
Parameters	**Method and Description**	**Return**
string	**getContractFromCEL()** Returns a set of media contractual objects as defined in 7.1.1 from an MPEG-21 CEL contract	Contract
string	**getContractFromMCO()** Returns a set of media contractual objects as defined in 7.1.1 from an MPEG-21 MCO contract	Contract
string	**validateCELContract()** Returns a conformance report of the MPEG-21 CEL contract given as input.	string
string	**validateMCOContract()** Returns a conformance report of the MPEG-21 MCO contract given as input.	string

10 API for MPEG-21 CEL/MCO generator

This clause specifies the API for the MPEG-21 CEL/MCO generator. This API shall be used in conjunction with MPEG-21 XML and RDF media contracts (ISO/IEC 21000-19, ISO/IEC 21000-20, and ISO/IEC 21000-21).

Methods		
Parameters	**Method and Description**	**Return**
Contract	**getCELFromContract()** Returns an MPEG-21 CEL contract from a set of media contractual objects as defined in 7.1.1	string
Contract	**getMCOFromContract()** Returns an MPEG-21 MCO contract from a set of media contractual objects as defined in 7.1.1	string

11 Reference software and conformance

The reference software is organized with the following structure:

- **MPEG-21 template contracts**
  - *XML*
  - *RDF*

  - *JSON-LD*
- **MPEG-21 Contract Expression Language (CEL)**
  - *MPEG-21 CEL parser*
  - *MPEG-21 CEL generator*
  - *MPEG-21 CEL contracts to smart contracts for media (forward conversion)*
    - Solidity/Ethereum[1)]
    - Michelson/Tezos[1)]
  - *Smart contracts for media to MPEG-21 CEL contracts (backward conversion)*
    - Solidity/Ethereum
    - Michelson/Tezos
- **MPEG-21 Media Contracts Ontology (MCO)**
  - *MPEG-21 MCO parser*
  - *MPEG-21 MCO generator*
  - *MPEG-21 MCO contracts to smart contracts for media (forward conversion)*
    - Solidity/Ethereum
    - TEAL/Algorand[1)]
  - *Smart contracts for media to MPEG-21 MCO contracts (backward conversion)*
    - Solidity/Ethereum
    - TEAL/Algorand
- **OpenAPI and demo**
  - *OpenAPI*
  - *MPEG-21 MCO OpenAPI server*
  - *MPEG-21 CEL server*
  - *Demo*

The reference software workflow is shown in Figure 4, including its modules for the bidirectional conversion from MPEG-21 CEL/MCO contracts to smart contracts for media. The complete description of the modules is given in the following subclauses, while the associated ISO/IEC 21000-23 Smart contracts for media reference software can be downloaded at https://standards.iso.org/iso-iec/21000/-23/ed-1/en/.

1) Solidity/Ethereum, Michelson/Tezos and TEAL/Algorand are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of these products.

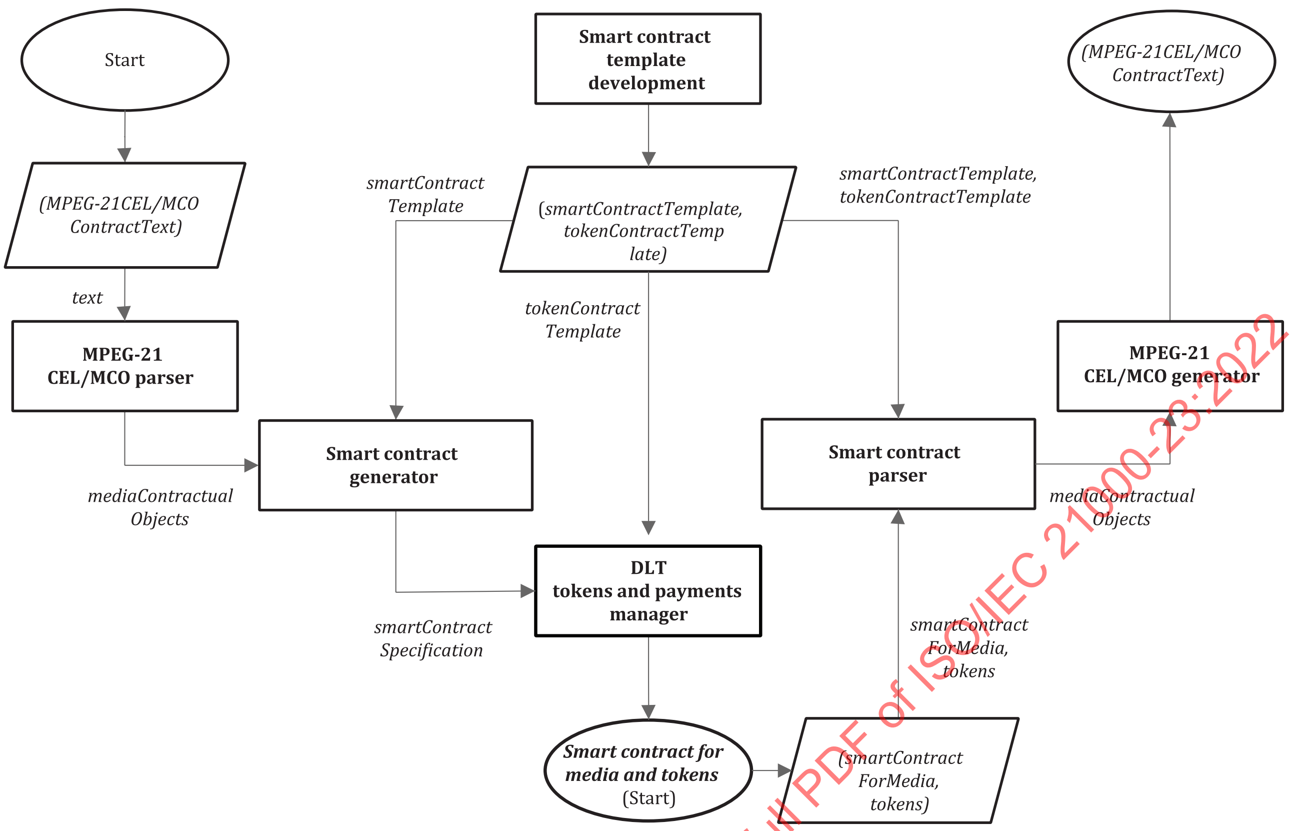

Start
(MPEG-21CEL/MCO ContractText)
text
MPEG-21 CEL/MCO parser
mediaContractual Objects
Smart contract template development
smartContract Template
(smartContractTemplate, tokenContractTemplate)
tokenContract Template
Smart contract generator
smartContract Specification
DLT tokens and payments manager
Smart contract for media and tokens (Start)
smartContractTemplate, tokenContractTemplate
Smart contract parser
smartContract ForMedia, tokens
(smartContract ForMedia, tokens)
(MPEG-21CEL/MCO ContractText)
MPEG-21 CEL/MCO generator
mediaContractual Objects

Figure 4 — Reference software workflow modules including inputs and outputs for the bidirectional conversion from MPEG-21 CEL/MCO contracts to smart contracts for media

11.1 MPEG-21 template contracts

The template contracts within the "*MPEG-21 template contracts*" folder are used as examples for conversion to smart contracts for media. However, these contracts have only informative status. That is, technology providers may similarly create new template contracts or adapt the ones provided as it fits to support their business models.

The collection of MPEG-21 template contracts derives from the Open Music Initiative (OMI) use cases[7]. The subfolders are:

— **XML** - Contains template contracts expressed in ISO/IEC 21000-20:2016 Contract Expression Language, formatted as XML files.

— **RDF** - Contains template contracts expressed using the ISO/IEC 21000-21:2017 Media Contracts Ontology, formatted as RDF/TURTLE files.

— **JSON-LD** - Contains template contracts expressed using the ISO/IEC 21000-21:2017 Media Contracts Ontology, formatted as JSON-LD files.

11.1.1 Open Music Initiative use cases

Each subfolder in the "*MPEG-21 template contracts*" folder contains a representation in CEL/MCO of the following contracts:

— **On demand stream "Big labels"** - For record labels that have a direct deal with services.

— **On demand stream "Indie labels"** - For record labels that are represented by a digital aggregator/distributor.