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Foreword

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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.

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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.

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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

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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.

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