## Call for Proposals (CfP) on technologies for MPEG-21 IPR contracts to smart contracts conversion











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Media Value Chain Ontology



**Audio Value** Chain Ontology

Media Contract Ontology

Smart Contracts

# Blockchain

# **Contract Expression** Language

Webinar | July 23, 2020 | 15:00 & 19:00 CEST

Further info: https://tinyurl.com/y7u4avak

# Call for Proposals (CfP) on technologies for MPEG-21 IPR contracts to smart contracts conversion



Торіс	Presenter	Affiliation	
Background	Panos Kudumakis (15mins)	QMUL	
Μνςο	Víctor Rodríguez-Doncel (5mins)	UPM	
AVCO	Panos Kudumakis (5mins)	QMUL	
МСО	Jaime Delgado (5mins)	UPC	
CEL	Xin Wang (5mins)	<b>Golden Forrestal</b>	
Logistics	Mihai Mitrea (5mins)	Telecom SudParis	
Questions	All (20mins)		

#### Thu 23 July 2020 @ 15:00 &19:00 CEST

#### Background



## Dr Panos Kudumakis Queen Mary University of London

#### **Copyright Legislation & Technology**

- Copyright legislation has continuously evolved with the aim to support the media industry, in face of technology progress, so that fair revenues are returned to artists and rights holders, multiterritory licensing, timely payments, and overall more transparency are improved. US Music Modernisation Act and EU Copyright Directive Reform are examples of these trends.
- Meanwhile, several key artists and media companies have turned their hopes for resolving these issues to technology and in particular, towards blockchain.
- Initiatives investigating blockchain have been launched in both sides of the Atlantic: Open Music Initiative by BerkleeICE in US & Mycelia by Imogen Heap in UK.

MPEG-21 IPR contracts (ontologies & schemas)					
Acronym	Standard				
MVCO	ISO/IEC 21000-19, 'Information technology Multimedia framework (MPEG-21) Part 19: Media value chain ontology', June 2010.				
	ISO/IEC 21000-8/AMD2, 'Information Technology Multimedia Framework (MPEG-21) Part 8: Reference software / AMD2 Reference software for media value chain ontology', Nov. 2011.				
AVCO	ISO/IEC 21000-19:2010/AMD1, 'Information Technology Multimedia Framework (MPEG-21) Part 19: Media Value Chain Ontology / AMD 1 Extensions on Time-Segments and Multi-Track Audio', June 2018.				
	ISO/IEC 21000-8:2008/AMD4, 'Information Technology Multimedia Framework (MPEG-21) Part 8: Reference Software / AMD 4 Media Value Chain Ontology Extensions on Time-Segments and Multi-Track Audio', Oct. 2018.				
МСО	ISO/IEC 21000-21 (2 <sup>nd</sup> Ed.), ' <u>Information technology Multimedia framework</u> (MPEG-21) Part 21: Media Contract Ontology', May 2017.				
CEL	ISO/IEC 21000-20 (2 <sup>nd</sup> Ed.), 'Information technology Multimedia framework (MPEG-21) Part 20: Contract Expression Language', Dec. 2016.				

#### **Benefits of MPEG IPR Ontologies**

- MPEG IPR ontologies can be used by music and media value chain stakeholders to share and exchange all metadata and contractual information connected to creative works, in a standardised and interoperable way, leading to transparent payment of royalties and reduced time spend 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 (true facts) and logic based on rich semantic copyright models expressed by MPEG IPR ontologies. In such way, the data derived are unambiguously interpretable facilitating efficient processing in B2C and B2B music and media value chains.

## The Challenge: From MPEG IPR Ontologies to Smart Contracts and Blockchains

How MPEG IPR standardised ontologies can be converted to smart contracts being executable on existing blockchain environments, thus

a) **enriching blockchain** environments with **inference and reasoning** capabilities inherently associated with ontologies, while

b) **increasing the trust level** among music and media value chain stakeholders **for sharing data** in the ecosystem, since the data will be cryptographically secured, and **its truth is verified by a blockchain**?

#### **Towards a Semantic Music and Media Blockchain**

- While lots of research literature deals with ontologies' semantic-level interoperability (linking different ontologies) and blockchains' protocol-level interoperability (transferring verified data from one to another), the interoperability gap between them has not yet been sufficiently addressed.
- Towards this direction, MPEG is not going to develop any blockchain based technology or any new language for smart contracts.
- MPEG aim is to develop the means (e.g., protocols and APIs) for converting MPEG IPR ontologies to smart contracts being executable on existing blockchain environments.
- Such developments towards a semantic music and media blockchain have the potential to unlock both the semantic web and the creative economy.

## Encoding semantic representations expressed by MPEG IPR Ontologies as metadata tags in smart contracts

## **MPEG IPR Ontologies**

<NamedIndividual rdf:about="#XXX"> <rdf:type rdf:resource="urn:mpeg:mpeg21:mco:pane:2015#**Payment**"/> <mco-pane:hasAmount>**1.00**</mco-pane:hasAmount> <mco-pane:hasCurrency>**GBP**</mco-pane:hasCurrency> <mvco:actedBy rdf:resource="#**UserA**"/> <mco-pane:hasBeneficiary rdf:resource="#**UserB**"/> </NamedIndividual>

То

## Move Transfer UserA UserB £1

#### **Problem & Hints for Solution**

A standard way to translate MPEG-21 contracts to smart contracts will ensure users that the smart contract executed by a blockchain corresponds to the human-readable MPEG-21 contract.

#### Problem

 Panos Kudumakis, Thomas Wilmering, Mark Sandler, Víctor Rodríguez-Doncel, Laurent Boch, Jaime Delgado, <u>'The Challenge: From MPEG</u> <u>Intellectual Property Rights Ontologies to Smart Contracts and</u> <u>Blockchains</u>', IEEE Signal Processing Magazine, pp. 89-95, Vol. 37, Issue 2, March. 2020.

#### Hints for Solution

 Olivia Choudhury, Nolan Rudolph, Issa Sylla, Noor Fairoza, Amar Das, <u>'Auto-Generation of Smart Contracts from Domain-Specific</u> <u>Ontologies and Semantic Rules</u>', IEEE Blockchain, Halifax, Canada, 30 July-3 Aug. 2018.

#### **MPEG-21 IPR Ontologies: Interlingua for Smart Contracts Conversion**



XML/RDF  $\leftarrow$   $\rightarrow$  JSON  $\leftarrow$   $\rightarrow$  Abstract Syntax Tree  $\leftarrow$   $\rightarrow$  Smart Contract

**API to be Standardised** 



XML/RDF  $\leftarrow$   $\rightarrow$  JSON  $\leftarrow$   $\rightarrow$  Abstract Syntax Tree  $\leftarrow$   $\rightarrow$  Smart Contract

**API to be Standardised** 



**Call for Proposals: Requirements** 

A standard way to translate MPEG-21 contracts to smart contracts will ensure users that the smart contract executed by a blockchain corresponds to the human-readable MPEG-21 contract.

With this aim, the requirements for interoperable conversion of **MPEG-21 IPR contracts to smart contracts** are stated:

- 1. MPEG-21 IPR contracts shall be converted to smart contracts for any blockchain. In that way the interoperability gap between ontologies and blockchains is bridged.
- 2. MPEG-21 IPR contracts shall be converted to smart contracts for any blockchain and **in a reversible way**. In that way the interoperability gap on data transferred between blockchains is also bridged.

#### **Call for Proposals: Use Cases**

Use cases dealt with are about how the money flows back to song writers, artists, publishers and labels, when their music is streamed on interactive services, sold on the digital platforms and played on the radio.

In particular, for interactive streams and digital sales, how the money flows depends on what entity negotiated the license (e.g., record labels having a direct deal with services, record labels represented by digital a aggregator/distributor artists and owning recording copyrights and using distribution services), while for radio and radio-like services, blanket licenses determine who gets paid and how much.



- 1. Identify / create tools for converting MPEG IPR Ontology based contracts to smart contracts (e.g., Go, Solidity, Move)
- 2. Implement the chain XML/RDF to JSON to Abstract Syntax Tree to Smart Contract using for the last conversion different smart contracts languages (e.g., Go, Solidity, Move)
- 3. Explore the use of MPEG IPR Ontologies as smart contracts in IM AF (ISO/IEC 23000-12) & possibly CMAF (ISO/IEC 23000-19)

### Media Value Chain Ontology (ISO/IEC 21000-19)



## Dr Víctor Rodríguez-Doncel Universidad Politécnica de Madrid

MPEG-21 IPR Ontologies serve as data models for representing intellectual property rights and their transfer in contracts.

## **MPEG-21 IPR Ontologies**

- MVCO Media Value Chain Ontology
  - AVC Audio Value Chain Ontology
- MCO Media Contract Ontology
  - IPRE Intellectual Property Rights
  - PANE Payments and Notifications
  - RELE Rights Expression Language

#### **MVCO (Media Value Chain Ontology)**



#### **MVCO: Actions, Users & IP Entities**



**Users** (*Creator*, *Adaptor, Instantiator, Producer...*) assigned *Roles* that attribute to them rights over **Actions** that can be exercised on corresponding **IP Entities**.

#### **MVCO: Permissions**



**Permissions** are supported by MVCO. However, the **specific conditions** of the permissions are represented in MCO.

#### **MVCO** permissions along the value chain



#### **Example of MVCO class instances representing permissions**



## Audio Value Chain Ontology (ISO/IEC 21000-19/AMD1)



## Dr Panos Kudumakis Queen Mary University of London

#### AVCO (Audio Value Chain Ontology) for content reuse

AVCO facilitates transparent IPR management even when **content reuse is involved**. This relates in particular to widespread adoption of **interactive music services** (remixing, karaoke, and collaborative music creation) enabled by MPEG-A: Interactive Music Application Format (ISO/IEC 23000-12), aka **Stems**, which raises the issue of rights monitoring when reuse of audio IP entities is involved, such as **tracks or even segments of tracks in new derivative works**.



#### **Time-Segments and Multi-Track Audio**

AVCO introduces the concepts of:

1) *timeline*: a linear and coherent piece of time in relation to time-based IP entities, e.g., a vocal track can be associated with such a timeline

2) *interval*: a temporal entity defined by a start and end points on a given timeline, e.g., the chorus interval of a vocal track

3) **segment**: a slice of an IP entity with boundaries defined by the interval's start and end points, e.g., the chorus interval's IP entity

4) *track*: a single track of a multitrack audio IP entity, e.g., the vocal track's IP entity.



Recordings representing visualized multitrack audio. A segment exists within an interval on a timeline.

An additional *reuse* action enables querying and granting permissions for the reuse of existing IP entities to create new derivative IP entities.

#### **Relationships for IP entity segments and tracks**



ACVO-defined classes and relationships for the representation of IP entities that contain other existing IP entities. Segments can also be associated with individual tracks of a multitrack audio IP entity.

#### Music Citation & Co-author Graphs (sharing in social nets & developing reputation)



## Media Contract Ontology - ISO/IEC 21000-21 (2<sup>nd</sup> Ed.)



## Prof. Jaime Delgado Universitat Politècnica de Catalunya

#### **MCO (Media Contract Ontology)**

- Part 21 of MPEG-21 (ISO/IEC 21000-21)
- Ontology model for CEL contracts
- Machine-readable ontology for representation of narrative contracts

- Includes a Core model (mco-core) and 2 extensions
- <u>Core model</u> based on MVCO generic deontic expressions (permission, prohibition, and obligation)
- <u>Extensions</u>:
  - Exploitation of Intellectual Property Rights (mco-ipre)
  - Payments and Notifications (mco-pane)

#### The main elements of the MCO model



## **Exploitation of IPR extension (1/2)**

- Express the **rights** for exploiting media content (audiovisual production companies, broadcasters, ...)
- Examples of rights: Public performance, Fixation (e.g., recorded on a tangible medium), Communication to the public, ...
- Exploitation rights might be associated with conditions (facts, modalities, access policies)
- Examples of **facts**: number of broadcast transmissions, time periods, territories, languages, exclusivity, royalty percentages, ...
- Examples of modalities: linear/broadcast, nonlinear/broadband, ...
- Examples of access policies / payment: free of charge, subscription, pay per view, ...

#### **Exploitation of IPR extension (2/2)**

- MCO core: actions permitted when conditions are met.
- IPR extension allows to specify dependencies between actions.
- Example of dependency: The exploitation of a right can trigger a condition for another action.
- <u>Specific example</u>: A broadcasting operator acquires the:
  - right from a production company to *broadcast* a TV episode,
  - right to make the TV episode available on demand from its website to its subscribers via broadband access *but only after* the TV episode has been broadcast.
- I.e., the communication to the public right via broadband is dependent upon the use of the former communication to the public via broadcast.

- Defines specific obligations for completing a media contract scenario.
- The payments and notifications obligations can either be *triggered* by rights exploitation actions, or required as a precondition to rights exploitation actions.
- The MCO (as the CEL) can be used for the conversion of narrative media contracts to digital ones and vice versa. Example in Radiotelevisione Italiana (MCO-based rights management system).
- MCO-based rights management systems could lead to B2B rights management interoperability.

#### **Exploitation of IP Rights**

#### **Payments & Notifications**







## Contract Expression Language - ISO/IEC 21000-20 (2<sup>nd</sup> Ed.)



## Dr Xin Wang Golden Forrestal

## **CEL (Contract Expression Language)**

- 1. History: MPEG-21 Part 20
  - Based on MPEG-21 Part 5, rights expression language (REL), for specifying licenses in digital rights management (DRM) systems
- 2. Purpose
  - To express contractual agreements in an unambiguous, machine interpretable form
- 3. Basic Concepts
  - **Contract**: an agreement between two or more parties over a number of promises
  - **Promise**: container of several clauses
  - Clause: "Subject" takes an "Act" on "Object" under "Constraint", upon "PreCondition" in "Context"

# Deontic Types of Clause

- permission: "subject" may take an "act" ...
- obligation: "subject" must take an "act" ...
- prohibition: "subject" must not take an "act" ...
- **statement:** "subject" takes, took, or will take an "act" ...

## **CEL Contract Example Template: Digital Sale**

Contract			
For all D, C, L, S, X			
Party: Music Distributor D			
Party: Music Consumer C			
Party: Music Label L			
Statement 1	Permission 3		
Subject: L	Pre-condition:		
Act: Provide	ActionStatus{Permission 2}: ActionDone		
Object: "Performance of <b>Song</b> " <b>S</b>	Subject: Consumer C		
Permission 1	Act: Consume		
Subject: D	Object: S		
Act: Provide	Obligation 1		
Recipient: C	Pre-condition:		
Object: S	ActionStatus{Permission 2}: ActionDone		
Permission 2	Subject: D		
Subject: Consumer C	Act: Pay		
Act: Pay	Recipient: L		
Recipient: D	Object: 95% * <b>\$X</b>		
Object: Purchase Fee \$X for S			

#### **Roles of CEL and REL in Media Transaction Systems**



A CEL contract can result in a REL license enforceable by DRM systems

# Logistics



## Dr Mihai Mitrea Telecom SudParis

## In a nutshell:

1. Formal framework:

- ISO/IEC JTC 1/SC 29/WG 11 N19504 Call for Proposals on technologies for MPEG-21 IPR contracts to smart contracts conversion
- 2. Expected answers include:
  - The technical description of the protocols and application programming interfaces under the scope of the call
  - Two additional information forms (cf. Annex A and B)
- 1. Submission address: Jörn Ostermann, chair of the MPEG Requirements sub-Group (<u>ostermann@tnt.uni-hannover.de</u>)

#### Time line:

1. Call for proposals:

Call for proposals: 2020.07.03

- Submission deadline: 2020.10.06 (by 23:59 hours UTC)
- Evaluation of answers: 2020.10.10–10.16 during the MPEG meeting week - proponents are strongly advised to present their proposals
- The first working draft: 2020.10.16

#### Time line:

#### 1. Preliminary standard development plan

Year	Month	Day	MPEG	City	Country	Stage
			meeting			
2020	07	03	131	Geneva	CH	Approval of CfP
				(Virtual)		
	10	16	132	Rennes	FR	Draft WD
				(Virtual)		
2021	01	15	133	Cape Town	ZA	Approval of WD
	03	30	134	Geneva	СН	Approval of CD
	07	16	135	Prague	CZ	Approval of DIS
	10	15	136	Antalya	TR	Approval of FDIS

#### Answering the Call for proposals

#### Some details – expected answer structure (1/3)

- 1. The technical description of your solution
  - be specific in your solution
  - clearly state your solution
  - comment and document your solution
  - be ready for a demo showing how it works and how somebody else can use it

## Some details – expected answer structure (2/3)

- 1. Annex A Information form
  - Title of the proposal
  - Organization (i.e., name of proposing company)
  - What does your proposal apply to?
  - What is the main functionality of your proposal?
  - Do you plan to attend the 132nd MPEG meeting and make a presentation to explain your proposal and answer questions about it?
  - Will you provide a demonstration to show how your proposal meets the evaluation criteria?

## Some details – expected answer structure (2/3)

- 1. Annex B Evaluation sheet
  - Name of the Proposed Description:
  - Main Functionality:
  - Summary of Proposal: (a few lines)
  - Comments on relevance to MPEG-21 IPR contracts to smart contracts conversion:
  - Evaluation (synoptic table Criteria/Evaluation facts/Conclusions)
  - New Requirements Identified:
  - Summary of the evaluation:
  - Main strong points, qualitatively: (2-3 lines summary)
  - Main weak points, qualitatively: (2-3 lines summary)
  - Overall evaluation: (0/1/2/3/4/5)

### Some details – evaluation criteria (1/2)

- 1. Requirements: The MPEG-21 IPR contracts to smart contracts conversion technology shall support the identified requirements.
- 2. Adaptability / Extensibility: If the proposed technology does not explicitly express the capability of supporting all the requirements, it shall be clearly extensible or shall demonstrate its extensibility to support other requirements and/or other smart contract technologies.
- 3. Execution performance: Generation, processing/conversion, and integration of MPEG-21 IPR contracts with existing blockchain technologies shall be supported by a demonstration.

## Some details – evaluation criteria (2/2)

- 4. Information loss: Amount and type of any information loss during the MPEG-21 IPR contracts to smart contracts conversion and, in particular, during the reversible process shall be identified.
- 5. Validation: The conformance of MPEG-21 IPR contracts and corresponding smart contracts shall be validated throughout the processing/conversion chain (desirable).
- 6. Availability: Software tools shall be available for the demonstration of the proposals (desirable).

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UPC





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