Semantic Technologies for Copyright Management

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• Motivation
• Introduction
• Approach
• Conceptualisation
• Implementation
• Conclusions
Motivation

• Why *copyright management* on the Web is more important than ever?
• And why *Digital Rights Management* isn’t enough?
• Why *semantic technologies* seem a good choice for Web-scale copyright management?
Motivation - Use Case

• Web media business models go **beyond digital** version of “**copy/distribute**” vinyls, cassettes, CDs, DVDs,…
• Growing **Streaming** (Spotify, Pandora, Netflix, Hulu…)
• Promising big scale **remixing** (make money if others reuse your content): **User Generated Content** (UGC)
Motivation - Use Case

- UGC from reused media
Motivation - Use Case

YouTube™ AudioID & YouTube™ VideoID

match

match

match

AudioID

VideoID

match

match

match
Motivation - Use Case

"Gangnam Style", +33,000 videos using it, more than $870,000 ad revenue - New York Times, Dec 7th 2012

Choices:
- Block
- Track
- Monetize

match
Motivation - Use Case

• What if more than one ownership claim?

• If disputed, no one can monetize
Motivation - Use Case

- Are we **sure** we can claim?
- Do we own that particular **copy**?
- In that **territory**?
- Also streaming on **YouTube**?
- Does the **artist** authorise YouTube?
- …

**DRM → Copyright Management**
Motivation - Use Case

…1000s of pieces of registered content…
…1000s of videos on YouTube…

• Decision Support System (DSS):
  – Disputes with Media.com on A and B, can we claim?
  – Trade A for B with Media.com (both win, start to get revenue)
Motivation - Use Case

- Rights DSS requirements:
  - **Fine grained**
  - Scalable (largely **automatized**)
  - Takes **into account**:
    - **Contracts**
      “…all rights on the live version but studio version just in the US.”
    - **Policies**
      “…artist does not want his music together with violent images”.
    - **Rights Expression Languages**
      DDEX metadata:
      ```xml
      <UseType>OnDemandStream</UseType>
      <TerritoryCode>Worldwide</TerritoryCode>
      ```
Green Day’s Contract: “Avoid making available our work together with war images”

Monetize “Bullet in a Bible” in YouTube.com?

Digital Operations says YES but we should check Green Day’s contract...

<isrc>USREV0500293</isrc>
<DealTerms>
  <ValidityPeriod>
    <StartDate>2005-11-15</StartDate>
  </ValidityPeriod>
  <Usage>
    <UseType>OnDemandStream</UseType>
    <DistributionChannelType>Internet</DistributionChannelType>
  </Usage>
  <TerritoryCode>US</TerritoryCode>
</DealTerms>
Green Day’s Contract: “Avoid making available our work together with war content.”
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Introduction

• Digital media: easy production and copy
• Digital Rights Management (DRM)

• Windows Media DRM, iTunes FairPlay, RealNetworks Helix, Sony MagicGate…
Introduction

- Internet: easy distribution
- DRM interoperability
Introduction

• Need for a standard REL (Rights Expression Language)

• Some efforts:
  – XML-based RELs
    • Formal syntax
      XML Schema for standard grammar
    • Informal semantics
      Rights Data Dictionaries

  – Creative Commons
    simple predefined licenses …but copyright management
Introduction

• XML-based RELs:
  – Limited expressivity
  – No interoperability mechanisms
  – Informal semantics, re-implement for each tool

• Creative Commons:
  – Predefined set of licenses
    • Extension mechanism CC+ but unstructured
  – Non-commercial purposes
  ...but semantic metadata
Introduction

• DRM Watch: “2005 Year in Review: DRM Standards”¹
  – “...consumer complaints have moved beyond overly restrictive DRMs to lack of interoperability among them…”
  – “…we see no production implementations…”

• Electronic Frontier Foundation²
  – “…fail to accommodate… copyright regimes.”

• Some years after...

¹ http://www.drmwatch.com ² http://www.eff.org
Introduction

• DRM Officially Dead: Last Major Label Sony BMG Plans to Finally Drop DRM
  Gizmodo.com, January 2008

• DRM Was a Bad Move: Sales Found to Increase 10% After Dropping the Chains (Study)
  Billboard.com, December 2013

• And industry moving to copyright management initiatives:
  – PLUS Coalition, Linked Content Coalition, CopyrightHub,…
  …and even considering semantic data and ontologies
Introduction

• Post-DRM standardisation difficulties
  – Web open and heterogeneous
  – Business models beyond copy and distribute
  – Copyright a complex domain
  – High level of abstraction (not bits or pixels)

• Concentrate on the roots, formalise SEMANTICS

- Copyright
- Reproduction Right
- Copy
- MPEG-21 “Adapt”
- ODRL “Duplicate”
- CC “Reproduction”
From Controlled Vocabularies…

to Ontologies

<table>
<thead>
<tr>
<th>Features</th>
<th>Controlled Vocabularies</th>
<th>Synonyms</th>
<th>Taxonomies</th>
<th>Thesaurus</th>
<th>Ontologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Ambiguity</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Synonym</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hierarchical Relations</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associative Relations</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Custom Relations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

INCREASE EXPRESSIVENESS
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- Implementation
- Conclusions
Approach

- Semantic Web approach to DRM:
  - Knowledge Representation tools
  - Web Wide applicability
  - Build Copyright Ontology

- Potential benefits:
  - Formalise **semantics**
  - Facilitate **interoperability** and **implementation**
  - Include **copyright**
  - Support **full value chain** and **remix–based** business models
Contents

- Motivation
- Introduction
- Approach
- Conceptualisation
- Implementation
- Conclusions
Conceptualisation

- Copyright domain analysis
- Generic Ontology
  - Based on WIPO\(^1\) worldwide harmonisation
- Literary, artistic and scientific works (not ideas)
- Maybe derived, but always original

---

1 World Intellectual Property Organisation Copyright Treaty, 1996
## Conceptualisation

<table>
<thead>
<tr>
<th>Exploitation Right (Copyright)</th>
<th>MoralRight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproduction Right</td>
<td>Dissemination Right</td>
</tr>
<tr>
<td>Fixation Right</td>
<td>Paternity Right</td>
</tr>
<tr>
<td>Sound Recording Right</td>
<td>Respect Right</td>
</tr>
<tr>
<td>Motion Picture Right</td>
<td>Withdrawal Right</td>
</tr>
<tr>
<td>Communication Right</td>
<td></td>
</tr>
<tr>
<td>Broadcast Right</td>
<td>Neighbouring Rights</td>
</tr>
<tr>
<td>Public Performance Right</td>
<td>Performers, Producers, Broadcasters Rights</td>
</tr>
<tr>
<td>Distribution Right</td>
<td>Sui Generis Right</td>
</tr>
<tr>
<td>Rental Right</td>
<td></td>
</tr>
<tr>
<td>Transformation Right</td>
<td>Rights Exceptions</td>
</tr>
<tr>
<td>Adaptation Right</td>
<td>Private Copy</td>
</tr>
<tr>
<td>Translation Right</td>
<td>Quotation</td>
</tr>
<tr>
<td></td>
<td>Education</td>
</tr>
</tbody>
</table>

...
Conceptualisation

• How rights apply to the “Peer-to-Peer asset sharing scenario”
Conceptualisation

- Complex domain, build model in three steps:
  
  Creation Model

  Rights Model

  Action Model
Conceptualisation
Creation Model

Abstractions

Victor Hugo's
Les Misérables

Work

Objects

Manifestation
Fixation
Instance

Processes

Performance
Communication
Conceptualisation
Creation Model

• Work
  – “Mozart's The Magic Flute”. ISWC

• Manifestation

• Performance
  – “A scenic play”.

• Fixation
  – “A sound recording”. ISRC

• Communication
  – “An Internet stream”.

• Instance
  – “A CD”. UPC

\[\text{Conceptualisation} \xrightarrow{\text{Derivation}} \text{Manifestation} \xrightarrow{\text{Performance}} \text{Fixation} \xrightarrow{\text{Communication}} \text{Instance}\]
Conceptualisation

Rights Model

Economic Rights
- Distribution Right
- Fixation Right
- Reproduction Right
- Public Performance Right
- Communication Right
- Transformation Right

Copyright
- Attribution Right
- Integrity Right
- Disclosure Right
- Withdrawal Right

Moral Rights
- Performing Rights
- Producers Rights
- Broadcasters Rights

Related Rights
- Rental Right
- Importation Right
- Sound Recording Right
- Motion Picture Right
- Broadcasting Right
- Making Available Right
- Adaptation Right
- Translation Right
Conceptualisation

Rights Model

• End-users do not hold rights
  – Get licenses to use (play, view…)
  – Special permissions:
    • Quotation
    • Education
    • Information
    • Official Act
    • Private Copy
    • Parody
    • Temporary Reproduction
Conceptualisation

Action Model

- Actions, the building blocks
Conceptualisation

Action Model

• Actions governed by Economic Rights:
  – Reproduction Right:
    copy
  – Distribution Right:
    distribute; sell, rent, lend
  – Public Performance Right:
    perform
  – Fixation Right:
    record
  – Communication Right:
    communicate; retransmit, broadcast, make available
  – Transformation Right:
    derive; adapt, translate
Conceptualisation
Action Model

• End-user actions, to use a...
  - manifestation: buy
  - instance: buy
  - performance: attend
  - communication: access
    • broadcast: tune
    • something made available: access

  picture, sculpture
  book, CD, DVD
  projection, recital, exhibition
  TV channel, radio station
  web page, stream
Conceptualisation
Action Model

• Altogether: model copyright value chains
  – E.g. “serials adapted from literary works”

Diagram:
- Creator
- Actor
- Producer
- Broadcaster
- User

- Literary Work
- Script
- Motion Picture
- Performance
- Communication
- Adaptation
- Adapt
- Manifest
- Perform
- Record
- Broadcast
- Tune
Conceptualisation
Action Model

- **Case roles** (linguistics): relate actions to involved entities

<table>
<thead>
<tr>
<th>Facet</th>
<th>Main role</th>
<th>Other roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who?</td>
<td>agent</td>
<td>participant (indirect co-agent), recipient</td>
</tr>
<tr>
<td>When?</td>
<td>pointInTime</td>
<td>start, completion, duration</td>
</tr>
<tr>
<td>Where?</td>
<td>location</td>
<td>origin, destination, path</td>
</tr>
<tr>
<td>What?</td>
<td>object</td>
<td>patient (changed), theme (unchanged)</td>
</tr>
<tr>
<td>With?</td>
<td>instrument</td>
<td>medium</td>
</tr>
<tr>
<td>Why?</td>
<td>aim</td>
<td>reason</td>
</tr>
<tr>
<td>How?</td>
<td>manner</td>
<td></td>
</tr>
<tr>
<td>If?</td>
<td>condition</td>
<td></td>
</tr>
<tr>
<td>Then?</td>
<td>consequence</td>
<td></td>
</tr>
</tbody>
</table>
Conceptualisation

Action Model

• License building primitives:
  - **Action Patterns:** to state what is obliged, permitted or prohibited
  - **Built from actions and case roles**

Scenario

```
 granted

  agent

  2007-06-01
  T00:00+01

  start

  P6M

  duration

  theme

  origin

  destination

  0..2

Copy

content01

peerA

peerB peerC peerD
```

All **copy** events performed by agent “**granted**” who copies “**content01**” from “**PeerA**” to **two peers** from the set “**PeerB, PeerC, PeerD**” at any time point **six months after “2007-06-01”**
Conceptualisation

Action Model

- License building primitives:
  - **Agree**: model permissions
    - *theme* points to the permitted event pattern

```
Scenario

grantee

granted

granted

2007-06-01
T00:00+01
P6M

Agree

pointInTIme

agent

agent

theme

agent

start

duration

Copy

content01

peerA

peerB
peerC
peerD

origin

destination

0..2

2007-05-20
T13:15+01
```
Conceptualisation

Action Model

• License building primitives:
  – **consequence**: model obligations
  • Points to the obliged event pattern

Scenario

**Copy**
- `agent`: granted
- `start`: 2007-06-01 T00:00+01
- `duration`: P6M
- `theme`: content01
- `origin`: peerA
- `destination`: peerB peerC peerD
- `consequence`: 0..2

**Transfer**
- `agent`: granted
- `recipient`: granter
- `theme`: 3 €
Conceptualisation

Action Model

• License building primitives:
  – condition: model a priori conditions
    • Points to the condition event pattern
  – Disagree: model prohibitions
    • theme points to the prohibited event pattern

• Other concepts:
  • Additional actions: Transfer, Attribute,…
  • Time, Location
  • Logical operators (UNION, INTERSECTION, NOT)
  • …
Conceptualisation

Exercise

• Model this license using the previous primitives:
## Facet

### Main role
- **Who?** agent
- **When?** pointInTime
- **Where?** location
- **What?** object
- **With?** instrument
- **Why?** aim
- **How?** manner
- **If?** condition
- **Then?** consequence

### Other roles
- **participant (indirect co-agent), recipient**
- **start, completion, duration**
- **origin, destination, path**
- **patient (changed), theme (unchanged), result (new)**
- **medium**
- **reason**

---

### Other Actions:
- Agree, Disagree, Transfer, Attribute,…

---

### Work
- "Mozart's The Magic Flute". *ISWC*

### Manifestation
- "The printed scores". *ISBN*

### Performance
- "A scenic play".

### Fixation
- "A sound recording". *ISRC*

### Communication
- "An Internet stream".

### Instance
- "A CD". *UPC*

---

http://mediamixer.eu
http://rhizomik.net/mediamixer
http://rhizomik.net/ontologies/copyrightonto
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Implementation

- One conceptual model, many implementations
- **Semantic Web implementation** with Web Ontology Language (OWL)

- **Rights** and **License Patterns** implemented as **Classes**
  - Copyright, Reproduction Right, Copy, CopyPattern, ...

- **Uses** implemented as **Instances**
  - $u$

- *If $u$ is a Copy Pattern then* license pattern **authorises/prohibits** $u$
Implementation

• License Pattern (Class) built from constraints on kind of actions, agents, time points, locations, etc.

• OWL Building Blocks
  - **Classes** for actions (e.g. Copy)
  - Logical **operators** (AND, OR, NOT)
  - OWL **Restrictions**, constraints on case roles (e.g. *agent* all values from PublisherSubscribers)

© Roberto García 2007
Implementation

- **Copy** pattern restricted to:
  - digital object (**theme**)  
  - group of users (**agent**)  
  - non-commercial (**aim**)  

- depending on
  - time range (**pointInTime**)
Implementation

- Patterns allowed by Agrees and prohibited by Disagrees:
  - If not agreed → not allowed
  - If agreed and not disagreed → allowed
  - If disagreed → not allowed
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Generic Semantic Framework

Abstractions

transform

manifest

improvise

Processes

retransmit

Objects

manifest

improvise

Processes

retransmit

Literary Work

transform

manifest

process

fix

communicate

Instance

Manifestation

copy

Fixation

copy

Performance

Communicator

RentalRight

ImportationRight

FixationRight

SoundRecordRight

DistributionRight

ReproductionRight

MotionPictureRight

PublicPerformanceRight

BroadcastingRight

CommunicationRight

MakingAvailableRight

TransformationRight

AdaptationRight

AttributionRight

TranslationRight

IntegrityRight

DisclosureRight

WithdrawalRight

PerformersRights

ProducersRights

BroadcastersRights

Copyright

MoralityRights

EconomicRights

RelatedRights

Creator

Script

Actor

Performance

Producer

MotionPicture

Broadcaster

Communication

User

Tune

Tune

Tune
Aligned with other Schemas

```
schema.org
  Place
  TVEpisode

Action

Copyright Ontology
  Use
  location
  MakeAvailable
  subclass of
  CreationObject

DDEX Ontology
  OnDemandStream
  VideoScreenCapture

is a

ISO 3166
Country Codes
SA
```

Aligned with other Schemas
Applied to Facilitate Implementation using Reasoning

- Ontology provides building blocks to model and reason about contracts, policies, rights expression languages…

Can we stream asset X

Agree

Disagree

No, because it is matched to pattern

which prohibits it: “Artists does not want her music with violent images”
MediaMixer Demo

http://rhizomik.net/mediamixer/
MediaMixer Demo

http://rhizomik.net/mediamixer/rightsbuilderui/

Rights Builder UI

Agree #1

Restrictions

Agent: XYZ Media

Location: US

Patient: Creation

Theme: Creation
Policy 1: The licensor disagrees the licensee adapts media fragments containing...

<xml>
<right>
<play/>
</right>
<content
id="frg1"/>
</xml>

Rights Language Mapping

Rights Builder User Interface

Semantic Media Annotation

MediaMixer Semantic Techs

media fragments, semantic data, annotation, ontologies, reasoning,...

RDF Store & Reasoner
Thank you for your attention

More details:
http://community.mediamixer.eu
http://rhizomik.net/mediamixer
http://rhizomik.net/ontologies/copyrightonto

Contact:
Roberto García (@rogargon)
http://rhizomik.net/~roberto

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