

Using XACML for access control in Social Networks

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RESEARCH TOPICS


Creation, management and distribution of multimedia content in a secure and interoperable way

- Electronic commerce of multimedia services and products
- Metadata interoperability and ontologies
- Security, privacy and digital management of rights along the content life cycle
- Multimedia search
- Context handling and semantics
- Event reporting
- *Privacy and rights in online social networks*
- Contribution to Standardization: MPEG, JPEG, ...

Contents

- Context and motivation
- Open issues on access control policy languages for Social Networks
- Our approach
 - Interoperability with content-associated policies based on XACML
 - Rights Expression Languages, Policy languages and Social Networks
 - Negotiating access control rules using XACML
 - Semantic interoperability
- Conclusions

Context and motivation

- Web 2.0 (Social Networks) → PRIVACY
- Privacy needs to be protected! 
- *Our work done so far on Social Networks*
- *Issues to be solved*

Context and motivation

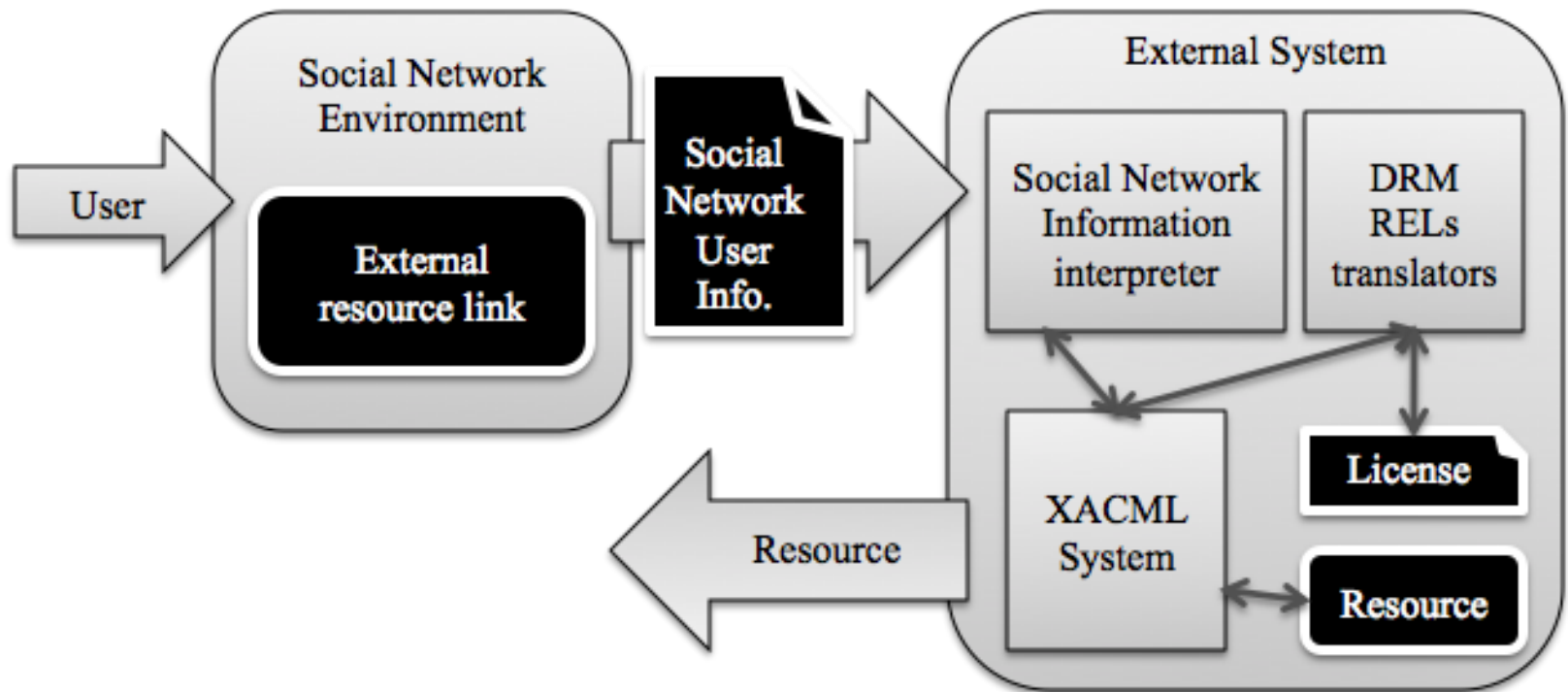
- Our work done so far on Social Networks:
 - Current privacy policies →
 - Identification of useful elements of DRM systems
 - Implementation of privacy policies (XACML, MPEG-21 REL, ODRL)
 - Interoperability of RELs based on XACML
 - Privacy model (context-aware applications)
- Issues that need to be solved:
 - Policy languages limitations for Social Networks
 - Interoperability among different policy languages

Open issues on access control policies languages for SNs

- **Access control policies languages limitations for SNs**
 - New type of “resources” need to be protected (relationships, events)
 - High degree of expressiveness is demanded by users (preferences)
 - Policy expressions mainly depend on the access context
 - Lack of a standard format expressing SNs context
- **Lack of semantic interoperability**
 - Different services, different access control policies languages, different contexts
- **Lack of control for “third parties” applications**
 - SNs’ users also need to control them
 - Access control models could be based on symmetric level of trust and have negotiation capabilities

Interoperability with content-associated policies based on XACML

- Users don't need to share all their data with the Service (i.e. Social Network) Provider



Demo application

- Facebook application to include protected content
- Linked to external system (outside Facebook)
- Licenses/policies specification for the content
- External system authorization

- **VIDEO**

http://dmag.ac.upc.edu/downloads/xmerjd_virtualgoods09.avi

Rights Expression vs Policy languages

- Digital Rights Management (DRM) systems enable the management of content through the complete digital value chain:
 - Content creation, adaptation, aggregation
 - Distribution, superdistribution, offers
 - Content consumption
- Rights Expression Languages (RELs) were devised to express the terms and conditions of use of content
- Policy languages exist to define which entities have access to which resources
- ***SNs requirements?***

REL vs PL: Social Networks Requirements

- Social Networks provide:
 - User (& relationships & actions) information
 - Sharing of user content
 - ...
- SNs need languages for the definition of content & user info usage rules (and their enforcement)
 - Control the usage (distribution, consumption, adaptation, negotiation, etc.) of personal data and digital content generated by the users
- Candidate languages:
 - Policy languages (from Access Control)
 - Rights Expression Languages (from Content Mngnt. & Prot.)

Policy languages & Social Networks

- SNs can use policy languages to define which entities have access to which resources
- *Do current policy languages (e.g. XACML) support negotiation, personal data management, and can express complex content & user info usage rules?*
 - Example of content usage rule:

“Only my workmates can see the company Christmas Dinner photo album during this month”
 - The accomplishment of this rule implies knowledge about users (“workmates”)

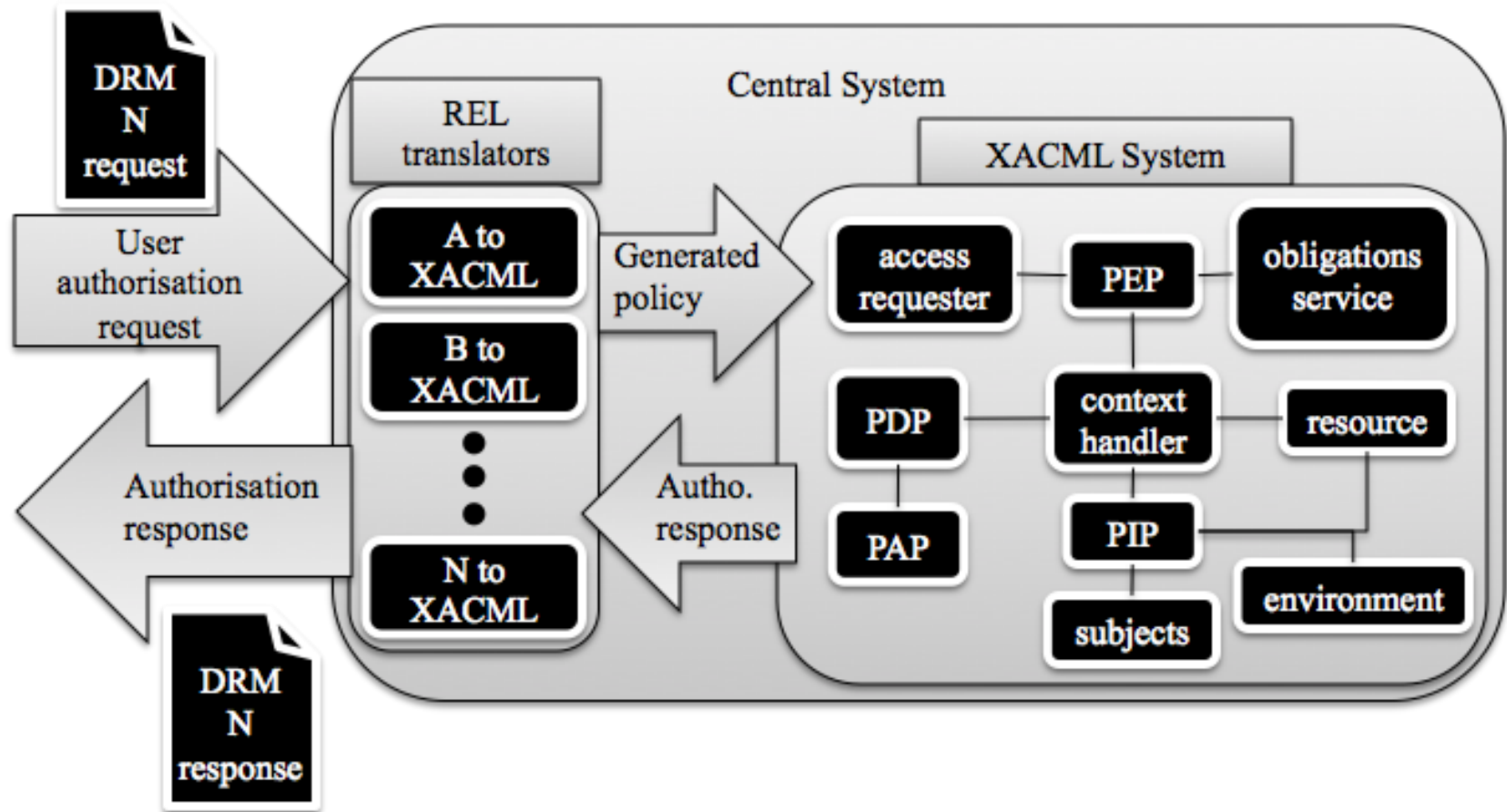
Rights Expression Languages & SNs

- RELs express the terms and conditions of use of content through the complete digital value chain
- *Do RELs support negotiation, personal data management, and can express complex content & user info usage rules?*
- Current RELs cannot express complex content usage rules needed in SNs
 - Previous example
 - Extensions must be defined with new rights, conditions, user characteristics, ...

XACML policy example

```
<Policy>
  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:SR1" Effect="Permit">
    <Target>
      <Subjects> <Subject>
        ...
        <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string"> Alice
workmates group </AttributeValue>
        ...
      </Subject> </Subjects>
      <Resources> <Resource>
        ...
        <AttributeValue
DataType="http://www.w3.org/2001/XMLSchema#string">/vc:ChristmasDinner</AttributeValue>
        ...
      </Resource> </Resources>
      <Actions> <Action>
        <ActionMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
          <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">
            view</AttributeValue>
          ...
        </ActionMatch>
      </Action> </Actions>
    </Target>
    <!-- Only during January 2010 -->
    <Condition> ... </Condition>
  </Rule>
</Policy>
```

Architecture for REL → XACML translation



MPEG-21 Example license

```
<?xml version="1.0" encoding="UTF-8"?>
<r:license licenselid="RightsObjectID" xmlns:dacx="urn:mpeg:mpeg21:2006:01-REL-DACX-NS"
xmlns:dsig="http://www.w3.org/2000/09/xml#sig" xmlns:mx="urn:mpeg:mpeg21:2003:01-REL-MX-NS"
xmlns:r="urn:mpeg:mpeg21:2003:01-REL-R-NS" xmlns:sx="urn:mpeg:mpeg21:2003:01-REL-SX-NS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:mpeg:mpeg21:2003:01-REL-R-NS ../schemas/rel-r.xsd
urn:mpeg:mpeg21:2003:01-REL-SX-NS ../schemas/rel-sx.xsd
urn:mpeg:mpeg21:2003:01-REL-MX-NS ../schemas/rel-mx.xsd
urn:mpeg:mpeg21:2006:01-REL-DACX-NS ../schemas/rel-dac.xsd">
  <r:grantGroup>
    <r:grant>
      <r:keyHolder>
        <r:info>
          <dsig:KeyName>URN:Rights:Holder:Unique.Id</dsig:KeyName>
        </r:info>
      </r:keyHolder>
      <mx:play/>
      <mx:diReference>
        <mx:identifier>URN:Resource:Unique.Id</mx:identifier>
      </mx:diReference>
      <r:allConditions>
        <r:validityInterval>
          <r:notBefore>2009-10-01T00:00:00</r:notBefore>
          <r:notAfter>2010-10-01T23:59:59</r:notAfter>
        </r:validityInterval>
      </r:allConditions>
    </r:grant>
  </r:grantGroup>
  <r:issuer>
    <r:keyHolder>
      <r:info>
        <dsig:KeyName>URN:Rights:Issuer:Unique.Id</dsig:KeyName>
      </r:info>
    </r:keyHolder>
  </r:issuer>
  <title>Rights Object Title</title>
</r:license>
```

ODRL Example license

```
<?xml version="1.0" encoding="UTF-8"?>
<o-ex:rights xmlns:o-ex="http://odrl.net/1.1/ODRL-EX"
xmlns:o-dd="http://odrl.net/1.1/ODRL-DD"
xmlns:ds="http://www.w3.org/2000/09/xmldsig#"
xmlns:enc="http://www.w3.org/2001/04/xmlenc#">
  <o-ex:context>
    <o-dd:version>1.1</o-dd:version>
    <o-dd:uid>RightsObjectID</o-dd:uid>
  </o-ex:context>
  <o-ex:agreement>
    <o-ex:asset>
      <o-ex:context>
        <o-dd:uid>URN:Resource:Unique:Id</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:party>
      <o-ex:context>
        <o-dd:uid>URN:Rights:Holder:Unique:Id</o-dd:uid>
      </o-ex:context>
    </o-ex:party>
    <o-ex:permission>
      <o-dd:play>
        <o-ex:constraint>
          <o-dd:datetime>
            <o-dd:start>2009-10-01T00:00:00</o-dd:start>
            <o-dd:end>2010-10-01T23:59:59</o-dd:end>
          </o-dd:datetime>
        </o-ex:constraint>
      </o-dd:play>
    </o-ex:permission>
  </o-ex:agreement>
</o-ex:rights>
```


XACML Example license

```
<?xml version="1.0" encoding="UTF-8"?>
<Policy xmlns="urn:oasis:names:tc:xacml:2.0:policy:schema:os" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:xacml:2.0:policy:schema:os http://docs.oasis-open.org/xacml/access_control-xacml-2.0-policy-schema-os.xsd"
PolicyId="RightsObjectID" RuleCombiningAlgId="identifier:rule-combining-algorithm:deny-overrides">
  <Description>Rights Object Title</Description>
  <Target>
    <VariableDefinition VariableId="000000001">
      <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:and">
        <Apply FunctionId="urn:oasis:names:tc:xacml:2.0:function:date-less-or-equal">
          <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:date-one-and-only">
            <EnvironmentAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:environment:current-date" DataType="http://www.w3.org/2001/XMLSchema#date"/>
          </Apply>
          <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:date-one-and-only">
            <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#date">2010-10-01T23:59:59</AttributeValue>
            <!--NotAfter-->
          </Apply>
        </Apply>
        <Apply FunctionId="urn:oasis:names:tc:xacml:2.0:function:date-greater-or-equal">
          <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:date-one-and-only">
            <EnvironmentAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:environment:current-date" DataType="http://www.w3.org/2001/XMLSchema#date"/>
          </Apply>
          <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:date-one-and-only">
            <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#date">2009-10-01T00:00:00</AttributeValue>
            <!--NotBefore-->
          </Apply>
        </Apply>
      </Apply>
    </VariableDefinition>
    <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:SimpleRule1" Effect="Permit">
      <Target>
        <Subjects>
          <Subject>
            <SubjectMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
              <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">URN:Rights:Holder:Unique:Id</AttributeValue>
              <SubjectAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:example:attribute:role" DataType="http://www.w3.org/2001/XMLSchema#string"/>
            </SubjectMatch>
          </Subject>
        </Subjects>
        <Resources>
          <Resource>
            <ResourceMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
              <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">URN:Resource:Unique:Id</AttributeValue>
              <ResourceAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:resource:target-namespase" DataType="http://www.w3.org/2001/XMLSchema#string"/>
            </ResourceMatch>
          </Resource>
        </Resources>
        <Actions>
          <Action>
            <ActionMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
              <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">play</AttributeValue>
              <ActionAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:action:action-id" DataType="http://www.w3.org/2001/XMLSchema#string"/>
            </ActionMatch>
          </Action>
        </Actions>
      </Target>
      <Condition>
        <VariableReference VariableId="000000001"/>
      </Condition>
    </Rule>
  </Policy>
```

MPEG-21 to XACML translation

```
<?xml version="1.0" encoding="UTF-8"?>
<r:license licenseld="RightsObjectID" xmlns:dacx="urn:mpeg:mpeg21:2006:01-REL-DACX-NS"
xmlns:dsig="http://www.w3.org/2000/09/xmldsig#" xmlns:mx="urn:mpeg:mpeg21:2003:01-REL-MX-NS"
xmlns:="urn:mpeg:mpeg21:2003:01-REL-R-NS" xmlns:sx="urn:mpeg:mpeg21:2003:01-REL-SX-NS"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:mpeg:mpeg21:2003:01-REL-R-NS ../schemas/rel-r.xsd
urn:mpeg:mpeg21:2003:01-REL-SX-NS ../schemas/rel-sx.xsd
urn:mpeg:mpeg21:2003:01-REL-MX-NS ../schemas/rel-mx.xsd
urn:mpeg:mpeg21:2006:01-REL-DACX-NS ../schemas/rel-dac.xsd">
  <r:grantGroup>
    <r:grant>
      <r:keyHolder>
        <r:info>
          <dsig:KeyName>URN:Rights:Holder:Unique:Id</dsig:KeyName>
        </r:info>
      </r:keyHolder>
      <r:keyHolder>
        <mx:play/>
      </r:keyHolder>
      <mx:diReference>
        <mx:identifier>URN:Resource:Unique:Id</mx:identifier>
      </mx:diReference>
      <r:allConditions>
        <r:validityInterval>
          <r:notBefore>2009-10-01T00:00:00</r:notBefore>
          <r:notAfter>2010-10-01T23:59:59</r:notAfter>
        </r:validityInterval>
      </r:allConditions>
    </r:grant>
  </r:grantGroup>
  <r:issuer>
    <r:keyHolder>
      <r:info>
        <dsig:KeyName>URN:Rights:Issuer:Unique:Id</dsig:KeyName>
      </r:info>
    </r:keyHolder>
  </r:issuer>
  <title>Rights Object Title</title>
</r:license>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<Policy xmlns="urn:oasis:names:tc:xacml:2.0:policy:schema:os" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:xacml:2.0:policy:schema:os http://docs.oasis-open.org/xacml/access_control-xacml-2.0-policy-schema-os.xsd"
PolicyId="RightsObjectID" RuleCombiningAlgId="identifier.rule-combining-algorithm:deny-overrides">
  <Description>Rights Object Title</Description>
  <Target/>
  <VariableDefinition VariableId="000000001">
    <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:and">
      <Apply FunctionId="urn:oasis:names:tc:xacml:2.0:function:date-less-or-equal">
        <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:date-one-and-only">
          <EnvironmentAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:environment:current-date" DataType="http://www.w3.org/2001/XMLSchema#date"/>
        </Apply>
      </Apply>
    </Apply>
  </VariableDefinition>
  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:SimpleRule1" Effect="Permit">
    <Target>
      <Subjects>
        <Subject>
          <SubjectMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
            <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">URN:Rights:Holder:Unique:Id</AttributeValue>
            <SubjectAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:example:attribute:role" DataType="http://www.w3.org/2001/XMLSchema#string"/>
          </SubjectMatch>
        </Subject>
      </Subjects>
      <Resources>
        <Resource>
          <ResourceMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
            <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">URN:Resource:Unique:Id</AttributeValue>
            <ResourceAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:resource:target-namespace" DataType="http://www.w3.org/2001/XMLSchema#string"/>
          </ResourceMatch>
        </Resource>
      </Resources>
      <Actions>
        <Action>
          <ActionMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
            <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">play</AttributeValue>
            <ActionAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:action:action-id" DataType="http://www.w3.org/2001/XMLSchema#string"/>
          </ActionMatch>
        </Action>
      </Actions>
      <Target>
        <Condition>
          <VariableReference VariableId="000000001"/>
        </Condition>
      </Target>
    </Rule>
  </Policy>
```

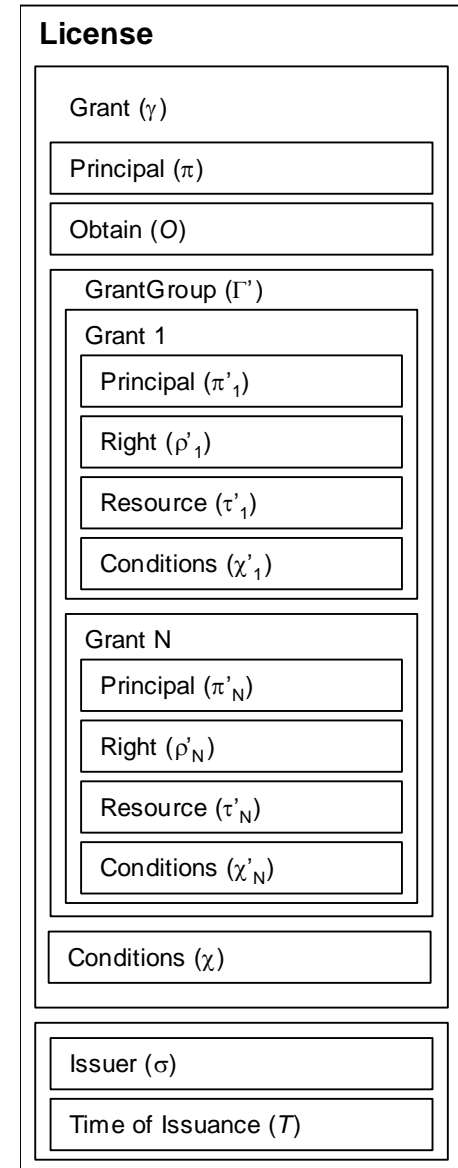
ODRL to XACML translation

```
<?xml version="1.0" encoding="UTF-8"?>
<o-ex:rights xmlns:o-ex="http://odrl.net/1.1/ODRL-EX"
xmlns:o-dd="http://odrl.net/1.1/ODRL-DD"
xmlns:ds="http://www.w3.org/2000/09/xmldsig#"
xmlns:enc="http://www.w3.org/2001/04/xmlenc#">
  <o-ex:context>
    <o-dd:version>1.1</o-dd:version>
    <o-dd:uid>RightsObjectID</o-dd:uid>
  </o-ex:context>
  <o-ex:agreement>
    <o-ex:asset>
      <o-ex:context>
        <o-dd:uid>URN:Resource:Unique:Id</o-dd:uid>
      </o-ex:context>
    </o-ex:asset>
    <o-ex:party>
      <o-ex:context>
        <o-dd:uid>URN:Rights:Holder:Unique:Id</o-dd:uid>
      </o-ex:context>
    </o-ex:party>
    <o-ex:permission>
      <o-dd:play>
        <o-ex:constraint>
          <o-dd:datetime>
            <o-dd:start>2009-10-01T00:00:00</o-dd:start>
            <o-dd:end>2010-10-01T23:59:59</o-dd:end>
          </o-dd:datetime>
        </o-ex:constraint>
      </o-dd:play>
    </o-ex:permission>
  </o-ex:agreement>
</o-ex:rights>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<Policy xmlns="urn:oasis:names:tc:xacml:2.0:policy:schema:os" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:xacml:2.0:policy:schema:os http://docs.oasis-open.org/xacml/access_control-xacml-2.0-policy-schema-os.xsd"
PolicyId="RightsObjectID" RuleCombiningAlgId="identifier.rule-combining-algorithm:deny-overrides">
  <Description>Rights Object Title</Description>
  <Target/>
  <VariableDefinition VariableId="000000001">
    <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:and">
      <Apply FunctionId="urn:oasis:names:tc:xacml:2.0:function:date-less-or-equal">
        <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:date-one-and-only">
          <EnvironmentAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:environment:current-date" DataType="http://www.w3.org/2001/XMLSchema#date"/>
        </Apply>
        <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:date-one-and-only">
          <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#date">2010-10-01T23:59:59</AttributeValue>
        </Apply>
        <NotAfter/>
      </Apply>
      <Apply FunctionId="urn:oasis:names:tc:xacml:2.0:function:date-greater-or-equal">
        <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:date-one-and-only">
          <EnvironmentAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:environment:current-date" DataType="http://www.w3.org/2001/XMLSchema#date"/>
        </Apply>
        <Apply FunctionId="urn:oasis:names:tc:xacml:1.0:function:date-one-and-only">
          <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#date">2009-10-01T00:00:00</AttributeValue>
        </Apply>
        <NotBefore/>
      </Apply>
    </Apply>
  </VariableDefinition>
  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:SimpleRule1" Effect="Permit">
    <Target/>
    <Subjects>
      <Subject>
        <SubjectMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
          <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">URN:Rights:Holder:Unique:Id</AttributeValue>
          <SubjectAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:2.0:example:attribute:role" DataType="http://www.w3.org/2001/XMLSchema#string"/>
        </SubjectMatch>
      </Subject>
    </Subjects>
    <Resources>
      <ResourceMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
        <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">URN:Resource:Unique:Id</AttributeValue>
        <ResourceAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:resource:target-namespace" DataType="http://www.w3.org/2001/XMLSchema#string"/>
      </ResourceMatch>
    </Resources>
    <Actions>
      <ActionMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
        <AttributeValue DataType="http://www.w3.org/2001/XMLSchema#string">play</AttributeValue>
        <ActionAttributeDesignator AttributeId="urn:oasis:names:tc:xacml:1.0:action:action-id" DataType="http://www.w3.org/2001/XMLSchema#string"/>
      </ActionMatch>
    </Actions>
    <Target/>
    <Condition>
      <VariableReference VariableId="000000001"/>
    </Condition>
  </Rule>
</Policy>
```

Negotiating access control using RELs

- RELs can be used to express offers
 - MPEG-21 REL, ODRL, ...
- Users propose to others the usage of their content according to the rights and conditions that they negotiate
- MPEG-21 REL example:



Negotiating access control using XACML

```
<Policy>
  <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:OF1" Effect="Permit">
    <Target>
      <Resources> <Resource>
        <Rule RuleId="urn:oasis:names:tc:xacml:2.0:example:VW1" Effect="Permit">
          <Target>
            <Resources> <Resource>
              ...
              <AttributeValue
DataTyPe="http://www.w3.org/2001/XMLSchema#string">/vc:video</AttributeValue>
              ...
            </Resource> </Resources>
            <Actions> <Action>
              <ActionMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
                <AttributeValue DataTyPe="http://www.w3.org/2001/XMLSchema#string">
view</AttributeValue>
              ...
            </Action> </Actions>
          </Target>
        </Rule>
      </Resource> </Resources>
      <Actions> <Action>
        <ActionMatch MatchId="urn:oasis:names:tc:xacml:1.0:function:string-equal">
          <AttributeValue DataTyPe="http://www.w3.org/2001/XMLSchema#string">
obtain</AttributeValue>
          ...
        </Action> </Actions>
      </Target>
    </Rule>
  </Policy>
```

Semantic Interoperability

- Current existing ontologies
 - Social Networks → Friend Of A Friend (FOAF)
 - Contextual Information → Delivery Context Ontology
 - DRM → Media Value Chain Ontology
 - ...

Not enough to express all possible
privacy requirements for SNs!

A lot of work needs to be done!

Conclusions

- Issues on access control policies for Social Networks have been analysed, including:
 - Access control policy languages limitations for SNs
 - Lack of semantic interoperability
- Possible approaches:
 - Use of Rights Expression Languages concepts to improve Policy languages for Social Networks
 - Interoperability with content-associated policies based on XACML
 - Negotiating access control rules using XACML
 - Extending ontologies to achieve semantic interoperability
- An extension to current Policy languages (XACML) to support SNs requirements may be needed

Using XACML for access control in Social Networks

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**Distributed Multimedia Applications Group (DMAG)
Universitat Politècnica de Catalunya (UPC)**

W3C Workshop on Access Control Application Scenarios
Luxembourg, 17 November 2009