LegalRuleML

LegalRuleML TC

OASIS LegalXML

Outline

- Introduction to LegalRuleML
- Bridging from RuleML to LegalRuleML
- LegalRuleML Metamodel
- Use Case #1: "Complaint"
- Use Case #2: "Infringement of Copyright"
- Conclusions and Future Plans

Outline of the Introduction

- Why LegalRuleML
- Goals and Principles of LegalRuleML
- OASIS LegalXML and LegalRuleML TCs
- Objectives of LegalRuleML
- LegalRuleML Principles

Why: Needs

- Legal texts are the source of norms, guidelines and rules that often feed into different concrete Web applications.
- Legislative documents typically provide general norms and specific procedural rules for eGovernment and eCommerce environments
- Contracts specify the conditions of services and business rules
- Judgements provide information about arguments and interpretation of norms that establish concrete case-law
- Guidelines (Soft Law) provide business and process rules in different sector
  - eGovernment, eJustice, eLegislation, eLaw
  - eHealth
  - Banks, assurances, credit card organizations
  - Cloud Computing
  - eCommerce

Goal

- The goal of the LegalRuleML is to extend RuleML with features specific to the formalisation of norms, guidelines, and legal reasoning.
- Didactical standard oriented for legal person in order to support the legal knowledge engineers
- Managing in agile way important functionalities of the legal domain in order to assign a specific semantic for avoiding to use too much generic RuleML elements
- Reduce the syntax and to obtain a "*shortcut*" annotation for legal domain more compact, effective, descriptiveness, human readable for legal background people

OASIS: background

- Not-for-profit consortium founded in 1993
- Open to all: companies, government agencies, academic and research institutions, individuals
- International **community**
  - 5,000+ participants including: 600+ organizations in 100+ countries
    - 33% in Europe 13% in Asia
- Technical agenda set by members
- Board and Committee chairs elected by member
- About of 65 TC now active in several domains including cloud computing, security and privacy, government and legal, smart grid, SOA and more

OASIS

OASIS and LegalXML

- LegalXML.org Community – 1998.
  - Legal, court, business, academic, and technology professionals.
  - Collaboration on non-proprietary standards for the legal community.

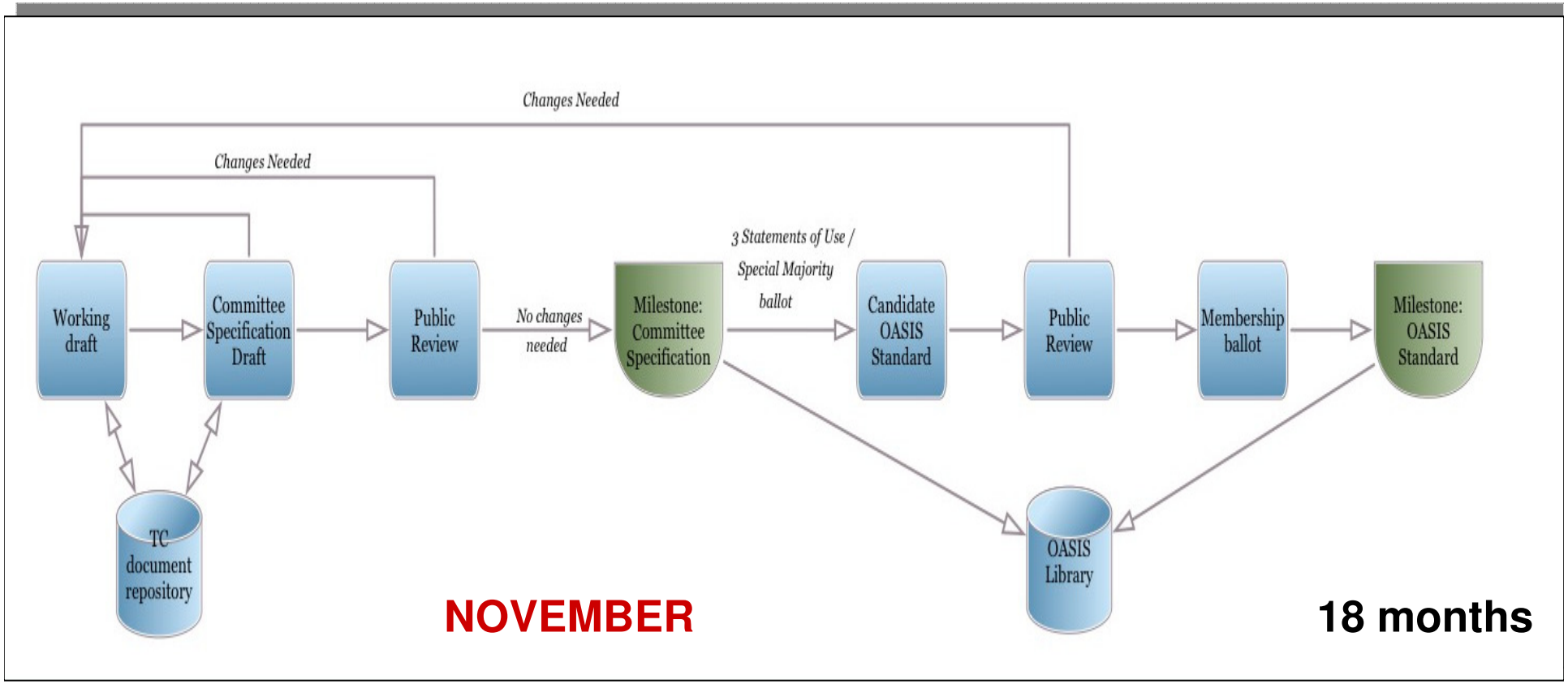
- OASIS LegalXML Member Section – March 2002.
- LegalRuleML started in Jan 2012
- LegalDocML started in March 2012

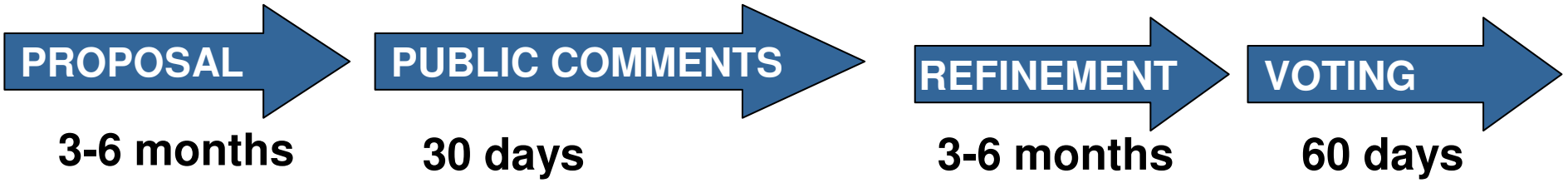
Why OASIS?

- Stable and robust governance of the standard
- International standard body certification
- All TC Members have equal participation rights
- All work (docs, emails, wiki, etc.) are publicly accessible
- Non-members contribute via comment lists
- Lightweight process focused on getting work done
- IPR Policy consistently receives high marks
- OASIS Standards can be submitted to *de jure* bodies (ISO, ITU, etc) for further ratification

OASIS

OASIS TC Workflow





OASIS

LegalRuleML Principles (1/2)

Multiple Semantic Annotations: A legal rule may have multiple semantic annotations where each annotation can represent a different legal interpretation. Each such annotation can appear in a separate annotation block as internal or external metadata. There is a range of parameters that can be set to provide the interpretation, e.g. provenance, applicable jurisdiction, logical interpretation of the rule, and others. Context of the rule should be recorded in an atomic and encapsulated block in order to realize the isomorphism principle.

Tracking the LegalRuleML Creators: As part of the provenance information, a LegalRuleML document or any of its fragments can be associated with its creators.

Linking Rules and Provisions (isomorphism): LegalRuleML includes a mechanism, based on IRI, that allows N:M relationships among the rules and the textual provisions:

- avoiding redundancy in the IRI definition and errors in the associations
- LegalRuleML is independent respect any Legal Document XML standard, IRI naming convantion

LegalRuleML Principles (2/2)

Temporal Management: Provisions references, rules, applications of rules and physical entities change in time, and their histories interact in complicated ways. LegalRuleML must represent these temporal issues in unambiguous fashion. In particular a rule has a range of parameters which can vary over time such as its status (e.g. strict, defeasible, defeater), its validity (e.g. repealed, annulled, suspended) and its jurisdiction (e.g. only in EU, only in US). In addition, a rule has a spectrum of temporal aspects such as internal constituency of the action, the time of assertion of the rule, the efficacy, enforcement, and so on.

Formal Ontology Reference: LegalRuleML is independent from any legal ontology and logic framework. It includes a mechanism, based on IRIs, for pointing to reusable classes of a specified external ontology.

LegalRuleML is based on RuleML: LegalRuleML reuses and extends concepts and syntax of RuleML wherever possible, and also adds novel annotations. RuleML includes also Reaction RuleML.

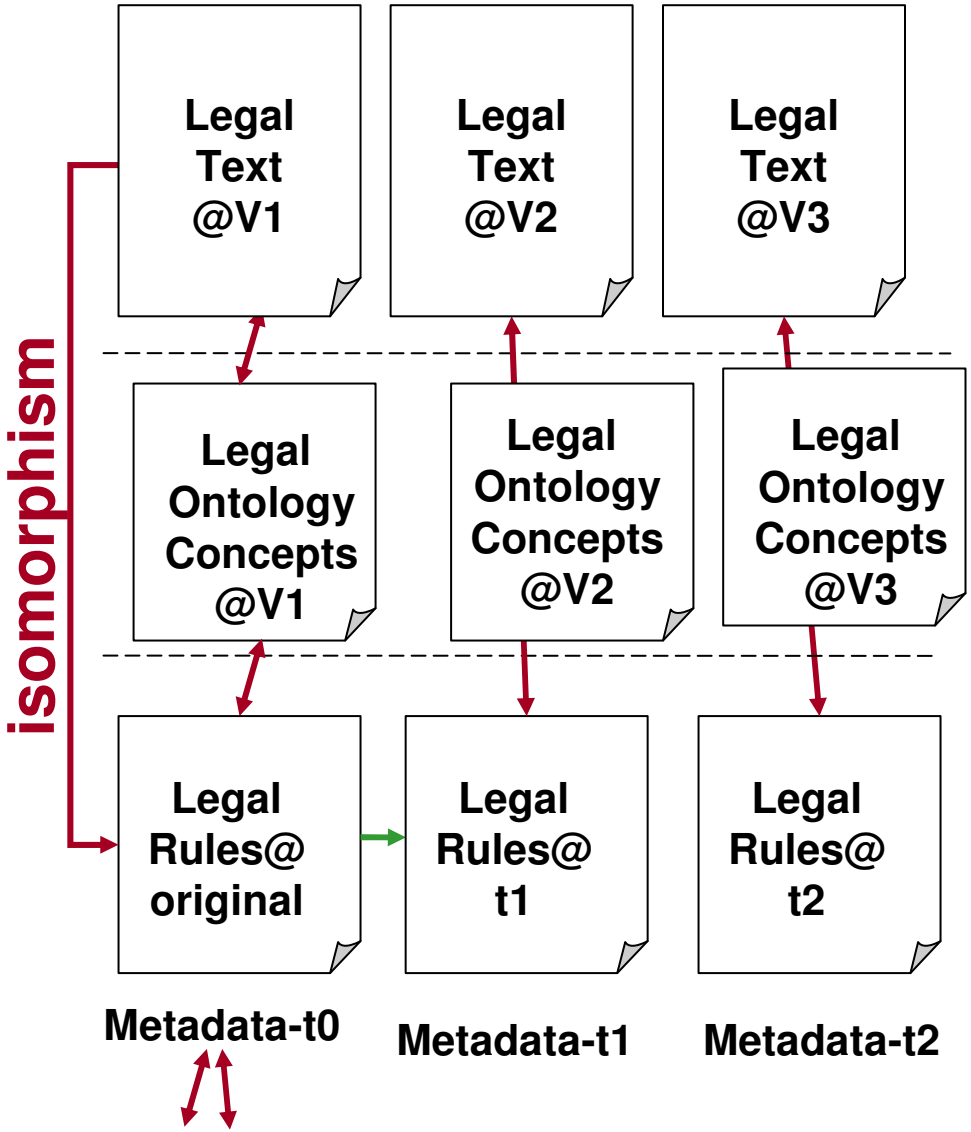
Mapping: Investigate the mapping of LegalRuleML metadata to RDF triples for favouring Linked Data reuse.

LegalRuleML Objective

- Extend RuleML Standard for managing in integrated way four main axes:
  - Legal Sources
  - Legal Rules including deontic and defeasibility
  - Legal Temporal dimensions
  - Legal Rule Context (e.g. jurisdiction, sovereignty, qualifications, authors, etc.)

- This permits:
  - To express the temporal parameters of the rules and their attributes/properties in atomic way (encapsulation)
  - To fill the gap between legal text and normative rule interpretation
  - capture the changes over time of the rules when the legal binding text changes
  - To open the door for an effective legal reasoning approach combining defesibility/behaviours and temporal dimensions

Scenario



- detect the rules and the ontology classes affected by the changes
- refer to the proper version of the text and of the ontology classes
- take in consideration the evolution of the rules over time with also theirs metadata fixed in a given time tx
- Sources, Rules (including deontic and defeasible properties) and context metatadata are “valid” in a given temporal interval.

LegalRuleML Metamodel

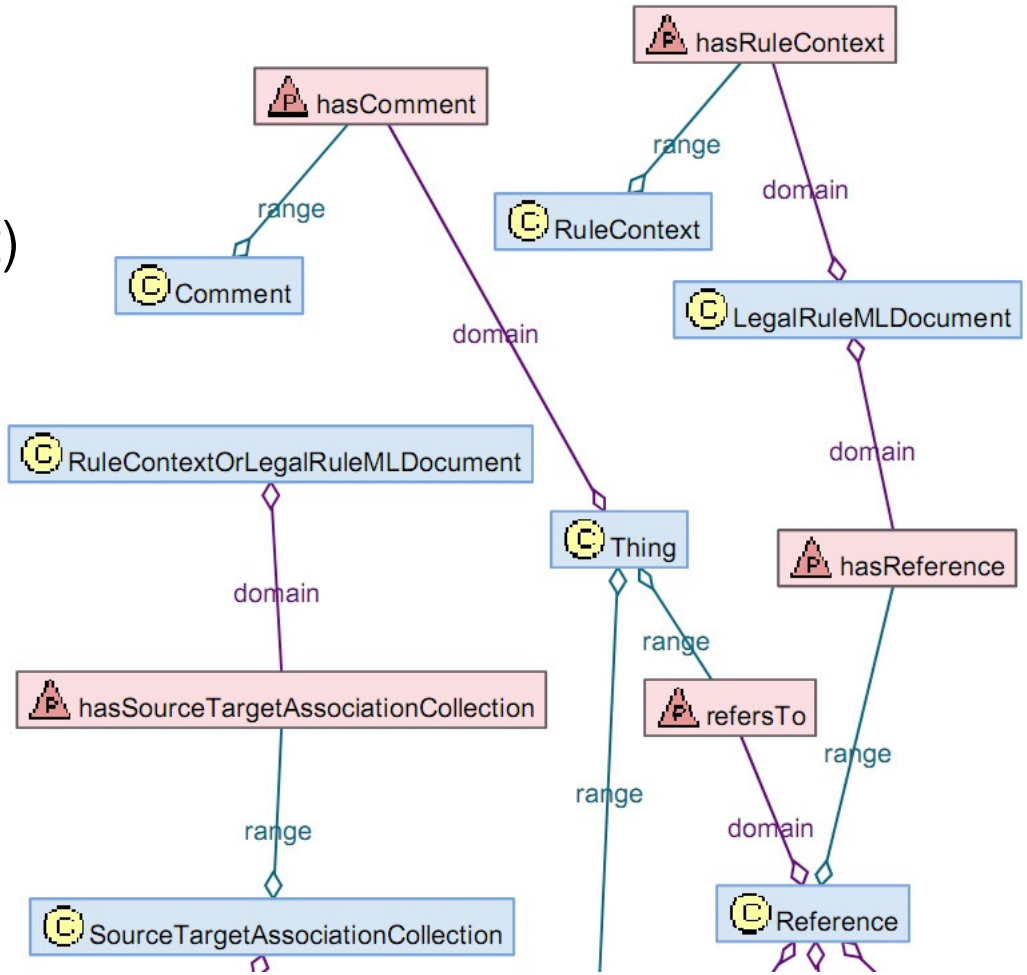
LegalRuleML TC

Tara Athan

OASIS LegalXML

Metamodel: Rule Context and (Legal) Sources

- Legal RuleML documents provide a context (RuleContext) for the legal rules expressed by textual provisions
- Context includes associations between sources and parts of the rules (SourceTargetAssocation)



RDF-based Syntax Development

1) Develop RDFS metamodel
2) Construct RDF instance
3) Abbreviate syntax
   1) Skip redundant edges
   2) Use attributes for unique IRI refs

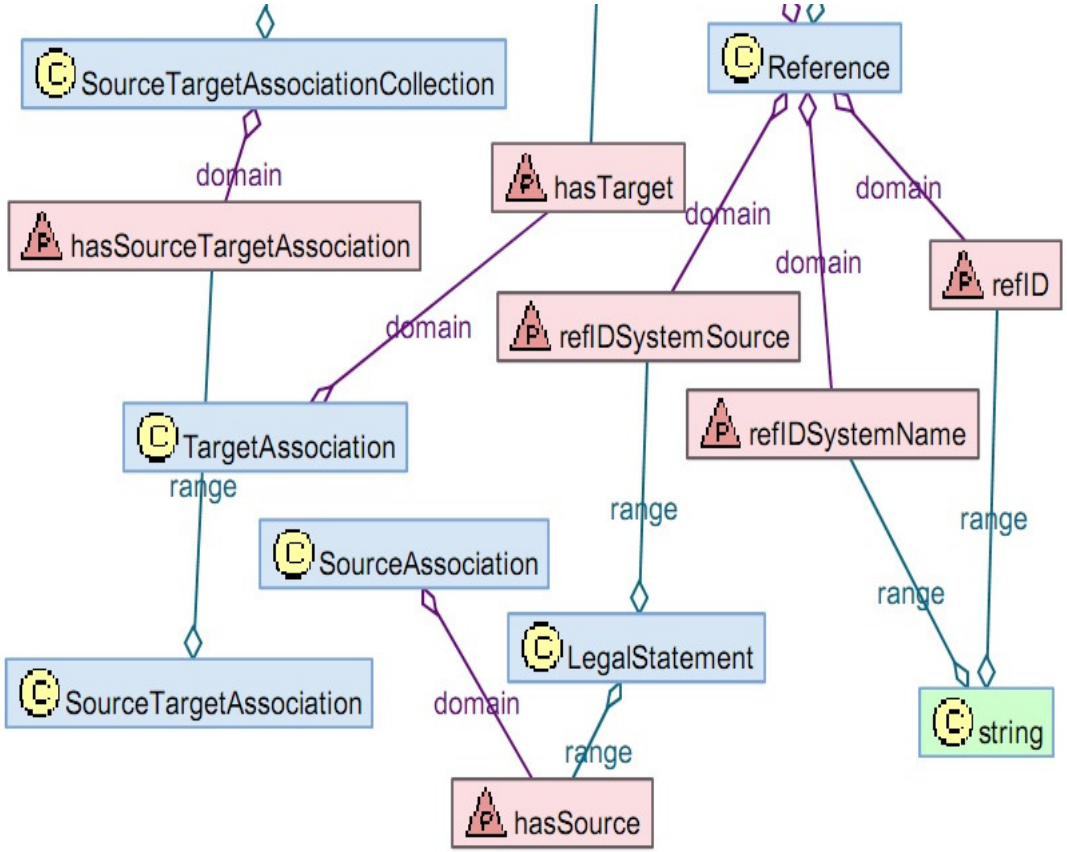
```
<rdf:RDF>
   <LegalRuleMLDocument
     rdf:about="#doc">
     <hasReferenceCollection
   rdf:parseType="Collection"
   >
       <Reference … />

   </hasReferenceCollection>
     ...

   <LegalRuleMLDocument
    rdf:about="#doc">
     <ReferenceCollection>
       <Reference ...
     </ReferenceCollection>
     ...
```

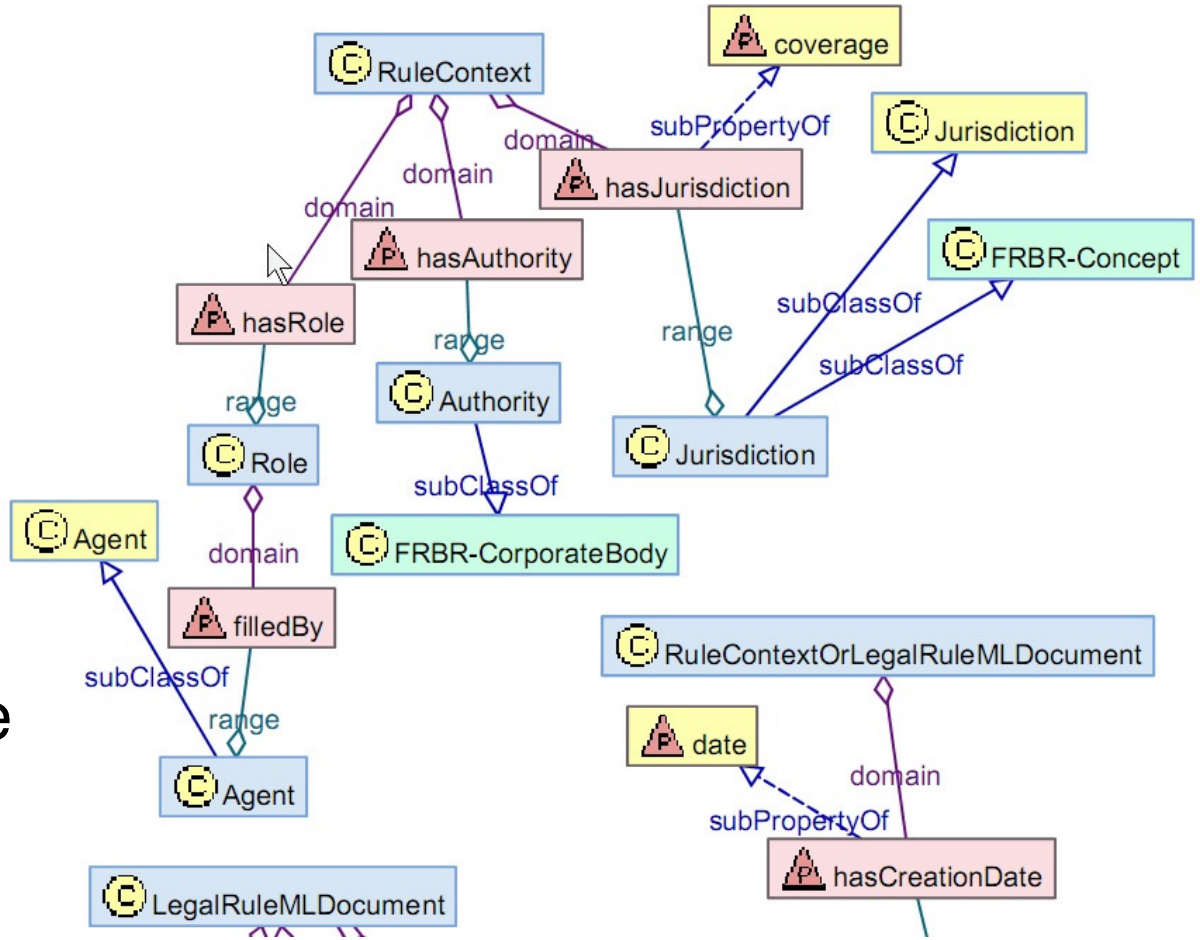
Metamodel: Legal Statements and References

- Sources are legal statements (often natural language)
- Legal statements with IRIs may be referenced directly
- Non-IRI-based identifier systems are associated with a same-document IRI reference using the Reference construct



Metamodel: Metadata Role, Authority, Jurisdiction

- Metadata concepts and properties are grounded in Dublin Core, FRBR as subclasses and subproperties
- Various roles, such as author or editor, are identified by the type of the Role concept



FRBR: Functional Requirements for Bibliographic Records

Document Structure: Collections, Contexts, Rulebases

- Collections
  - Labeled
  - Pass on properties
- Rule Contexts
  - Encapsulate legal interpretations
- Legal Rulebases
  - Encapsulate legal textual provisions

```
<LegalRuleMLDocument>

  <ReferenceCollection>
      <Reference> ...

  </ReferenceCollection>
    ...
    <RuleContext>
      ...
    </RuleContext>
    <LegalRulebase>
      <LegalRule>
        <ifLegalRule>
           ...RuleML...
        <thenLegalRule>
          ...RuleML...
```

Collections

- Sources
  - References
  - Legal Statements
- Agents
- Authorities
- Jurisdictions
- Resources
- Associations

```
<ReferenceCollection
    refIDSystemName=
   "AkomaNtoso2.0-2011-
  10">
    <Reference

  refersTo="#sec2.2-v1"
  refID=
         "&anx;sec2.2-
  v1"/>
      ...
  <AssociationCollectio
  n

  rdf:about="#sblock1">
    <Association>
      <hasSource
        rdf:resource=
        "#sec2.2-v1"/>
```

Associations

- Associations
  - two types of roles
  - N, M role fillers
  - N*M dyadic links
- Roles
  - Source
  - Target
  - Temporal Characteristics

```
<Association
    rdf:about="#sta1">
    <hasSource
        rdf:resource=
        "#sec2.2-v1"/>
    <hasSource
        rdf:resource=
        "#sec2.3-v1"/>
    <hasTarget
        rdf:resource=
        "#rule1"/>
    ...
  </Association>
```

Rule Contexts

- Roles
  - Author
  - Editor
- Associations
  - Source – Target
  - Temporal Characteristics - Target

```
<RuleContext
    rdf:about="#con1">
    <hasAssociation
        rdf:resource=
        "#sta1"/>
    <hasCollection
        rdf:resource=
        "#stac1"/>
    <Role>

  <rdf:type="#Author"/>

    <filledBy
        rdf:resource=
        "#agent1"/>
    ...
    <appliesTo

  rdf:resource="#rule1">
```

LegalRuleML Use Case #1 Defeasibility and Rule Sources

Guido Governatori and Monica Palmirani

OASIS LegalXML

Complaint example from Telecommunications Consumer Protections Code C628:2012, Australia

Date of Assent: 30 May 2012

Date of Registration: 11 July 2012

Date of Efficacy: 1 September 2012

2.1 sec2.1-v2

Complaint sec2.1-list1-itm31-v2

par1-v2 means an expression of dissatisfaction made to a Supplier in relation to its Telecommunications Products or the complaints handling process itself, where a response or Resolution is explicitly or implicitly expected by the Consumer.

par2-v2 An initial call to a provider to request a service or information or to request support is not necessarily a Complaint. An initial call to report a fault or service difficulty is not a Complaint. However, if a Customer advises that they want this initial call treated as a Complaint, the Supplier will also treat this initial call as a Complaint.

par3-v2 If a Supplier is uncertain, a Supplier must ask a Customer if they wish to make a Complaint and must rely on the Customer‟s response.

rule1a

rule1b

rule2

rule3

rule4

rule1b<rule2

rule1b<rule3

rule3<rule4

Complaint example from TCP Code C628:2012, Australia

```
<lrmlmm:LegalRule rdf:about="#rule1a-v2">
  <lrmlmm:Paraphrase> If X is a Complaint, then X <span>is an expression of
   dissatisfaction made to a Supplier in relation to its Telecommunications
   Products or the complaints handling process itself, where a response or
   Resolution is explicitly or implicitly expected by the Consumer</span>.
  </lrmlmm:Paraphrase>
  <lrmlmm:ifLegalRule>
   <ruleml:Atom node="#rule1-atom1-v2">
    <ruleml:Rel iri="#complaint-v2"/>
    <ruleml:Var>X</ruleml:Var>
   </ruleml:Atom>
  </lrmlmm:ifLegalRule>
  <lrmlmm:thenLegalRule>
   <ruleml:Atom node="#rule1-atom2-v2">
    <ruleml:Rel iri="#rule1-rel2-v2">is an expression of
   dissatisfaction made to a Supplier in relation to its Telecommunications
   Products or the complaints handling process itself, where a response or
   Resolution is explicitly or implicitly expected by the Consumer</ruleml:Rel>
    <ruleml:Var>X</ruleml:Var>
   </ruleml:Atom>
  </lrmlmm:thenLegalRule>
 </lrmlmm:LegalRule>
```

Relative IRI of the node

Defeasibility

```
<lrmlmm:Overrides lrmlmm:over="#rule2-v2"
  lrmlmm:under="#rule1b-v2">
</lrmlmm:Overrides>

<lrmlmm:Overrides lrmlmm:over="#rule3-v2"
  lrmlmm:under="#rule1b-v2">
</lrmlmm:Overrides>

<lrmlmm:Overrides lrmlmm:over="#rule4"
  lrmlmm:under="#rule3">
</lrmlmm:Overrides>
```

Relative IRI to the node

```
<lrmlmm:ReferenceCollection lrmlmm:refType="&lrmlv;#IndustryCode"
    lrmlmm:refIDSystemName="AkomaNtoso2.0-2011-10">
        <lrmlmm:Reference lrmlmm:refersTo="#sec2.1-list1-itm31-par1-v2" lrmlmm:refID="&anx;sec2.1-
    list1-itm31-par1-v2"/>
</lrmlmm:ReferenceCollection>

<lrmlmm:RuleContext rdf:about="#ruleInfo1-v2" lrmlmm:hasStrength="&lrmlv;#defeasible">
        <lrmlmm:SourceTargetAssociationCollection rdf:about="#sourceBlock1-v2">
                <!-- rulebases -->
                <lrmlmm:SourceTargetAssociation>
                        <lrmlmm:hasTarget rdf:resource="#rulebase1-v2"/>
                        <lrmlmm:hasSource rdf:resource="#sec2.1-list1-itm31
                </lrmlmm:SourceTargetAssociation>
                <!-- rules -->
                <lrmlmm:SourceTargetAssociation>
                        <lrmlmm:hasTarget rdf:resource="#rule1a-v2"/>
                        <lrmlmm:hasTarget rdf:resource="#rule1b-v2"/>
                        <lrmlmm:hasSource rdf:resource="#sec2.1-list1-itm31-par1-v2"/>
                </lrmlmm:SourceTargetAssociation>
                <!-- atoms -->
                <lrmlmm:SourceTargetAssociation>
                        <lrmlmm:hasTarget rdf:resource="#rule1-atom1-v2"/>
                        <lrmlmm:hasTarget rdf:resource="#rule1-atom2-v2"/>
                        <lrmlmm:hasSource rdf:resource="#sec2.1-list1-itm31-par1-v2"/>
                </lrmlmm:SourceTargetAssociation>
                <!-- relations -->
                <lrmlmm:SourceTargetAssociation>
                        <lrmlmm:hasTarget rdf:resource="#rule1-rel2-v2"/>
                        <lrmlmm:hasSource rdf:resource="#defn-complaint-v2"/>
                </lrmlmm:SourceTargetAssociation>
        </lrmlmm:SourceTargetAssociationCollection>
</lrmlmm:RuleContext>
```

Type rule

Temporal attr.

Assiaction of the rules with the source

GRANULARITY PRINCIPLE

LegalRuleML Use Case #2 Temporal Model

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Tara Athan
Adrian Paschke

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Copyright law: temporal versions

- **Requirements**: associate rules to their sources over time and to assign temporal dimensions to the rules
- US "Digital Millenium Act" and modifications
- **Specific goal**: in t_x calculate the proper *statutory damage* in case of violation of the copyright taking in consideration all the exceptions and the modifications respect an fact.

17 USC Sec. 504

Remedies for infringement: Damages and profits

Interval of efficacy of the norm	Statutory Damages
[Jan. 1, 1978, March 1, 1989 [	**$250** <= statutoryDamages <= **$10,000**
[March 1, 1989, Dec. 9, 1999 [	**$500** <= statutoryDamages <= **$20,000**
[Dec. 9, 1999, ∞	**$750** <= statutoryDamages <= **$30,000**

USC_17_504@1976-10-19#title17-chp5-sec504-clsc-lst1-pnt2-subpar2

Efficacy period
[Jan. 1, 1978, March 1, 1989 [

(c) **Statutory Damages**. -

The copyright owner may elect an award of statutory damages for infringements in a sum of not less than **$250** or more than **$10,000** as the court considers just.

USC_17_504@1989-03-01#title17-chp5-sec504-clsc-lst1-pnt2-subpar2

Efficacy period
[March 1, 1989, Dec. 9, 1999 [

(c) **Statutory Damages**. -

The copyright owner may elect an award of statutory damages for infringements in a sum of not less than **$500** or more than **$20,000** as the court considers just.

USC_17_504@1999-12-09#title17-chp5-sec504-clsc-lst1-pnt2-subpar2

Efficacy period
[Dec. 9, 1999, ∞ [

(c) **Statutory Damages**. -

The copyright owner may elect an award of statutory damages for infringements in a sum of not less than **$750** or more than **$30,000** as the court considers just.

```
<lrmlmm:ReferenceCollection lrmlmm:refType="&lrmlv;#IndustryCode"
    lrmlmm:refIDSystemName="AkomaNtoso2.0-2011-10">
        <lrmlmm:Reference lrmlmm:refersTo="#sec2.1-list1-itm31-par1-v2"
    lrmlmm:refID="&anx;sec2.1-list1-itm31-par1-v2"/>
</lrmlmm:ReferenceCollection>

<lrmlmm:RuleContext rdf:about="#ruleInfo1-v2" lrmlmm:hasStrength="&lrmlv;#defeasible">
        <lrmlmm:AssociationCollection rdf:about="#sourceBlock1-v2">
                <!-- rulebases -->
                <lrmlmm:Association>
                        <lrmlmm:hasTarget rdf:resource="#rulebase1-v2"/>
                        <lrmlmm:hasSource rdf:resource="#sec2.1-list1-itm31-par1-v2"/>
                </lrmlmm:Association>
                <!-- rules -->
                <lrmlmm:Association>
                        <lrmlmm:hasTarget rdf:resource="#rule1a-v2"/>
                        <lrmlmm:hasTarget rdf:resource="#rule1b-v2"/>
                        <lrmlmm:hasSource rdf:resource="#sec2.1-list1-itm31-par1-v2"/>
                </lrmlmm:Association>
                <!-- atoms -->
                <lrmlmm:Association>
                        <lrmlmm:hasTarget rdf:resource="#rule1-atom1-v2"/>
                        <lrmlmm:hasTarget rdf:resource="#rule1-atom2-v2"/>
                        <lrmlmm:hasSource rdf:resource="#sec2.1-list1-itm31-par1-v2"/>
                </lrmlmm:Association>
                <!-- relations -->
                <lrmlmm:Association>
                        <lrmlmm:hasTarget rdf:resource="#rule1-rel2-v2"/>
                        <lrmlmm:hasSource rdf:resource="#defn-complaint-v2"/>
                </lrmlmm:Association>
```

ResourceCollection of Time Instants

LIST OF NEUTRAL TIME INSTANTS

```
<lrmlmm:ResourceCollection
   lrmlmm:memberType="&tmp;#Instant">
  <rdf:Resource rdf:about="#t1">
    <rdf:value>1978-01-01T01:01:00.0Z
  </rdf:value>
  </rdf:Resource>
    ...

    <rdf:Resource rdf:about="#t4">
   <rdf:value xsi:type="xs:dateTime"
        >2012-07-20T01:01:00.0Z</rdf:value>
   </rdf:Resource>
</lrmlmm:ResourceCollection>
```

OPTIONAL USE OF EXTERNAL TEMPORAL ONTOLOGY AND/OR XSD DATATYPE

ResourceCollection of Properties

```
<lrmlmm:ResourceCollection>
    <rdf:Property rdf:about="#TimeEfficacyStarts">
     <lrmlmm:withFluentType>
      <rdf:Resource rdf:about="&lrmlv;#Efficacy">
       <rdf:type rdf:resource="&ev2;#FluentType"/>
      </rdf:Resource>
     </lrmlmm:withFluentType>
     <lrmlmm:withEventType>
      <rdf:Resource rdf:about="&lrmlv;#Start">
       <rdf:type rdf:resource="&ev2;#EventType"/>
      </rdf:Resource>
     </lrmlmm:withEventType>
     <rdfs:domain rdf:resource="&ev1;#EventType"/>
     <rdfs:range rdf:resource="&tmp;#Instant"/>
    </rdf:Property>
    <rdf:Property rdf:about="#TimeEfficacyEnds">
     ...
```

FLUENT IS CHANGEABLE PROPERTY OF THE WORLD

ASSOCIATION TO LEGAL TEMPORAL AXES: INFORCE EFFICACY

EVENT IS SOMETHING THAT HAPPENS OR IS CONTEMPLATED AS HAPPENING

ResourceCollection of Temporal Characteristics: Property-Value Pairs

SEMANTIC IS ASSIGNED TO TEMPORAL RESOURCE e1

```
<lrmlmm:ResourceCollection>
    <rdf:Resource rdf:about="#e1">
     <lrmlmm:hasProperty
          rdf:resource="#TimeEfficacyStarts"/>
     <lrmlmm:hasValue rdf:resource="#t1"/>
    </rdf:Resource>
    <rdf:Resource rdf:about="#e2">
     <lrmlmm:hasProperty
          rdf:resource="#TimeEfficacyEnds"/>
     <lrmlmm:hasValue rdf:resource="#t2"/>
    </rdf:Resource>
  </lrmlmm:ResourceCollection>
```

ResourceCollection of Event Types

```
<lrmlmm:ResourceCollection>
 <lrmlmm:memberType
        rdf:resource="&ev1;#EventType"/>
 <rdf:Resource rdf:about="#tblock1">
  <lrmlmm:hasDefiningCharacteristics
        rdf:parseType="Collection">
   <rdf:Resource rdf:about="#e1"/>
   <rdf:Resource rdf:about="#e2"/>
  </lrmlmm:hasDefiningCharacteristics>
 </rdf:Resource>
</lrmlmm:ResourceCollection>
```

DEFINITION OF EVENT TYPE AS COLLECTION OF PROPERTY-VALUE PAIRS

```
<lrmlmm:RuleContext rdf:about="ruleInfo1"
 lrmlmm:hasStrength="&lrmlv;defeasible"
 lrmlmm:hasTemporalCharacteristics=
        "#tblock1"
 lrmlmm:hasCreationDate="#t4">
```

ASSOCIATION OF THE TEMPORAL BLOCK TO THE CONTEX RULE

```
<lrmlmm:RuleContext rdf:about="#ruleInfo1"
  lrmlmm:hasTemporalCharacteristics="#tblock0">
  <lrmlmm:AssociationCollection>
    <lrmlmm:Association>
      <lrmlmm:hasTemporalCharacteristics
                    rdf:resource="#tblock1"/>
      <lrmlmm:hasTarget rdf:resource="#rule1"/>
      <lrmlmm:hasTarget rdf:resource="#atom1"/>
      <lrmlmm:hasTarget rdf:resource="#body1"/>
    </lrmlmm:Association>
    <lrmlmm:Association>
      <lrmlmm:hasTemporalCharacteristics
                    rdf:resource="#tblock2"/>
      <lrmlmm:hasTarget rdf:resource="#head1"/>
    </lrmlmm:Association>
  </lrmlmm:AssociationCollection> ...
```

ASSOCIATION OF THE TEMPORAL BLOCK TO FRAGEMENT OF THE RULES

Rule

```
<Implies id="#rule1">
    <then>
        <And>
            <Atom id="rule1-atom1">
                <Rel iri="&lkif;#payFee">pay a min fee</Rel>
                <Var type="&lkif;#infranger">Y</Var>
                <Ind type="&lkif;#fee">$250</Var>
            </Atom>
            <Atom id="rule1-atom2">
                <Rel iri="&lkif;#payFee">pay a max  fee</Rel>
                <Var type="&lkif;#infranger">Y</Var>
                <Ind type="&lkif;#fee">$10,000</Var>
            </Atom>
        </And>
    </then>
    <if>
        <And>
            <Atom id="rule1-atom3">
                <Rel iri="&lkif;#Infringement">infranges copyright</Rel>
                <Var type="&lkif;#infranger">Y</Var>
            </Atom>
            <Atom id="rule1-atom4">
                <Rel iri="&lkif;#isCopyrightOwner">copyright owner</Rel>
                <Var type="&lkif;#copyrightOwner">X</Var>
            </Atom>
            <Atom id="rule1-atom5">
                <Rel iri="&lkif;#electStatutoryDamages">claim statutory damages
    </Rel>
                <Var type="&lkif;#copyrightOwner">X</Var>
            </Atom>
        </And>
```

Reaction RuleML
Representation of
Use Case #2

Prova 3 Representation with @metadata @scopes and guards[]

(http://prova.ws)

```
@src(USC_17_504@1989-03-01#title17-chp5-sec504-clsc-lst1-pnt2-subpar2)
@label(StatutoryDamage Statute1)
@efficacyDamageStatute([date(1978,1,1), date(1989,2,28)])
statute([250,10000]).
@src(USC_17_504@1999-12-08#title17-chp5-sec504-clsc-lst1-pnt2-subpar2)
@label(StatutoryDamage Statute2)
@efficacyDamageStatute([date(1989,3,1), date(1999,12,8)])
statute([500,20000]).
@src(USC_17_504@1999-12-09#title17-chp5-sec504-clsc-lst1-pnt2-subpar2)
@label(StatutoryDamage Statute3)
@efficacyDamageStatute([date(1999,12,9), _])
statute([750,30000]).

@label("StatutoryDamagesRule")
payFee(Infringer,CopyrightOwner,[MinAmount, MaxAmount]) :-
    infringes(Infringer,copyright),
    electStatutoryDamages(CopyrightOwner,ElectTime),
    @efficacyDamageStatute(ValdityInterval)
    statute([MinAmount,MaxAmount]) [during(ElecTime,ValidityInterval)].
```

Reaction RuleML Representation Statutory Damage Statute (1)

```
<Atom  key="#StatutoryDamage Statute1"> <!– statute 1-->
    <!-- descriptive  metdata -->
    <meta>  <Atom> <Rel>src</Rel><Ind>USC_17_504@1976-10-19#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
    <!-- qualification  metdata -->
    <qualification>

            <!– note: simplified version of efficacy;  could be also modeled in Reaction RuleML as a
                fluent situation (a changeable  truth property of the world) -->
           <Atom>
              <Rel iri="&lrml;efficacy">efficacyDamageStatute</Rel>
              <Interval>
                      < Time type="&ruleml;TimeInstant"><Data>1978-01-01</Data></Time>
                      < Time type="&ruleml;TimeInstant"><Data>1989-02-28</Data></Time>
               </Interval>
           </Atom>

    </qualification>
    <!– instance -->
    <Rel>statute</Rel>
     <Interval>
              <Ind type="&lkif;fee">$250</Ind><Ind type="&lkif;fee">$10,000</Ind>
    </Interval>
</Atom>
```

RRML: Statutory Damage Statute (2,3)

```
<Atom  key="#StatutoryDamage Statute2"> <!– statute 2-->
    <qualification>
            <Atom><Rel> efficacyDamageStatute </Rel>
               <Interval type="&ruleml;LeftClosedInterval"> >
                        < Time ><Data> 1989-03-01 </Data></Time>
                        < Time><Data>1999-12-08</Data></Time>
               </Interval>
            </Atom>
     </qualification>
    <Rel>statute</Rel>
     <Interval>
               <Ind type="&lkif;fee">$500</Ind><Ind type="&lkif;fee">$20,000</Ind>
    </Interval>
</Atom>
<Atom  key="#StatutoryDamage Statute3"> <!– statute 3-->
    <qualification>
            <Atom><Rel> efficacyDamageStatute </Rel>
               <Interval type="&ruleml;LeftClosedInterval">
                        < Time ><Data> 1999-12-09 </Data></Time>
               </Interval>
            </Atom>
    </qualification>
    <Rel>statute</Rel>
     <Interval>
               <Ind type="&lkif;fee">$750</Ind><Ind type="&lkif;fee">$30,000</Ind>
    </Interval></Atom>
```

RRML: Satutory Damage Rule ...

```
<Rule  style="reasoning"  key="#StatutoryDamagesRule"  >
  <if> <And>
      <Atom><Rel iri="&lkif;Infringement">infringes</Rel>
            <Var type="&lkif;infringer">Infringer</Var> <Ind>copyright</Ind>
      </Atom>
      <Atom> <!-- note: could be also modeled as an event-->
            <Rel iri="&lkif;electStatutoryDamages">electStatutoryDamages </Rel>
            <Var type="&lkif;copyrightOwner">CopyrightOwner</Var>
            <Var type="&ruleml;TimeInstant">ElectTime</Var>
      </Atom>
      <Atom>
             <scope> <!– scope definition: select knowledge  with metadata  efficacyDamageStatute-->
               <Atom>
                    <Rel iri="&lrml;efficacy"> efficacyDamageStatute </Rel>
                    <Var type="&ruleml;TimeInterval">ValidityInterval</Var> <!– binds validity -->
               </Atom>
            </scope>
             <guard><!–check if  election time of award  is during  validity time interval of efficacy -->
                        <Operator  type="&ruleml;During">
                              <Var>ElectTime</Var> <Var>ValidityInterval</Var>
                         </Operator>
            </guard>
            <Rel>statute</Rel><!– apply scoped literal only on selected scope which fulfills guard -->
            <Interval><Var >MinAmount</Var><Var >MaxAmount</Var> </Interval>
      </Atom>
    </And></if>   ....
```

RRML: … Satutory Damage Rule

```
    <then>
      <Atom>
          <Rel iri="&lkif;payFee">pay Fee</Rel>
          <Var type="&lkif;infringer">Infringer</Var>
          <Var type="&lkif;copyrightOwner">CopyrightOwner</Var>
          <Interval><Var >MinAmount</Var><Var >MaxAmount</Var> </Interval>
      </Atom>
    </then>
</Rules>
```

Reaction RuleML Translator Framework

```
@src(USC_17_504@1989-03-01#title17-chp5-sec504-clsc-lst1-pnt2-subpar2)
@label(StatutoryDamage Statute1)
@efficacyDamageStatute([date(1978,1,1), date(1989,2,28)]) statute([250,10000]).
@src(USC_17_504@1999-12-08#title17-chp5-sec504-clsc-lst1-pnt2-subpar2)
@label(StatutoryDamage Statute2)
@efficacyDamageStatute([date(1989,3,1), date(1999,12,8)]) statute([500,20000]).
@src(USC_17_504@1999-12-09#title17-chp5-sec504-clsc-lst1-pnt2-subpar2)
@label(StatutoryDamage Statute3)
@efficacyDamageStatute([date(1999,12,9), _]) statute([750,30000]).

@label("StatutoryDamagesRule")
payFee(Infringer,CopyrightOwner,[MinAmount, MaxAmount]) :-
        infringes(Infringer,copyright),
        electStatutoryDamages(CopyrightOwner,ElectTime), …
        @efficacyDamageStatute(ValidityInterval)
```

Prova 3 Representation with Fluents

(http://prova.ws)

```
% efficacy fluents which are initated and terminated by the start and end events
@src("USC_17_504@1976-10-19#title17-chp5-sec504-clsc-lst1-pnt2-subpar2")
@label("EfficacyStatutoryDamageStatute1")
initiates(startDamageStatute1, statute([250,10000]), T).
terminates(endDamageStatute1, statute([250,10000]), T).
@src("USC_17_504@1989-03-01#title17-chp5-sec504-clsc-lst1-pnt2-subpar2")
@label("EfficacyStatutoryDamageStatute2")
initiates(startDamageStatute2, statute([500,20000]), T).
terminates(endDamageStatute2, statute([500,20000]), T).
@src("USC_17_504@1999-12-09#title17-chp5-sec504-clsc-lst1-pnt2-subpar2")
@label("EfficacyStatutoryDamageStatute3")
initiates(startDamageStatute3, statute([750,30000]), T).
terminates(endDamageStatute3, statute([750,30000]), T).
```

```
% the events which occur due to modifications of the law
@src("USC_17_504@1976-10-19#title17-chp5-sec504-clsc-lst1-pnt2-subpar2")
happens(startDamageStatute1, date(1978,1,1)).
@src("USC_17_504@1989-03-01#title17-chp5-sec504-clsc-lst1-pnt2-subpar2")
happens(endDamageStatute1, date(1989,2,28)).
@src("USC_17_504@1989-03-01#title17-chp5-sec504-clsc-lst1-pnt2-subpar2")
happens(startDamageStatute2, date(1989,3,1)).
@src("USC_17_504@1999-12-09#title17-chp5-sec504-clsc-lst1-pnt2-subpar2")
happens(endDamageStatute2, date(1999,12,8)).
@src("USC_17_504@1999-12-09#title17-chp5-sec504-clsc-lst1-pnt2-subpar2")
happens(startDamageStatute3, date(1999,12,9)).
```

Prova 3 Representation with Fluents Statutory Damages Rule

(http://prova.ws)

```
@label("StatutoryDamagesRule1")
payFee(Infringer,CopyrightOwner,[MinAmount, MaxAmount]) :-
        infringes(Infringer,copyright),
        electStatutoryDamages(CopyrightOwner,ElectTime),
        holdsAt(statute([MinAmount,MaxAmount]),ElectTime).
```

(Note: other versions of this rule can be marked up with other metadata and qualifications managed in different modules in the knowledge base on which scopes (dynamic views) can be defined for selecting the applicable rule)

Reaction RuleML Representation Efficacy of Statutory Damage Statute (1)

```
<Initiates  key="#EfficacyStatutoryDamage Statute1"> <!– initiates efficacy fluent damage statute 1-->
    <meta>  <Atom> <Rel>src</Rel><Ind>USC_17_504@1976-10-19#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
    <on> <Event><Ind>startDamageStatute1</Ind></Event></on>
    <fluent>
        <Situation><Interval>
                <Ind type="&lkif;fee">$250</Ind><Ind type="&lkif;fee">$10,000</Ind>
        </Interval></Situation>
    </fluent>
    <at><Time><Var>T</Var></Time></at>
</Initiates>

<Terminates  key="#EfficacyStatutoryDamage Statute1">><!–terminates  efficacy fluent damage statute 1-->
    <meta>  <Atom> <Rel>src</Rel><Ind>USC_17_504@1976-10-19#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
    <on> <Event><Ind>endDamageStatute1</Ind></Event></on>
    <fluent>
        <Situation><Interval>
                <Ind type="&lkif;fee">$250</Ind><Ind type="&lkif;fee">$10,000</Ind>
        </Interval></Situation>
    </fluent>
    <at><Time><Var>T</Var></Time></at>
</Terminates>
```

Reaction RuleML Representation Efficacy Statutory Damage Statute (2)

```
<Initiates  key="#EfficacyStatutoryDamage Statute2"> <!– initiates efficacy fluent damage statute 2-->
    <meta>  <Atom> <Rel>src</Rel><Ind>USC_17_504@1989-03-01#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
    <on> <Event><Ind>startDamageStatute2</Ind></Event></on>
    <fluent>
        <Situation><Interval>
                <Ind type="&lkif;fee">$500</Ind><Ind type="&lkif;fee">$20,000</Ind>
        </Interval></Situation>
    </fluent>
    <at><Time><Var>T</Var></Time></at>
</Initiates>

<Terminates  key="#EfficacyStatutoryDamage Statute1">><!–terminates  efficacy fluent damage statute 2-->
    <meta>  <Atom> <Rel>src</Rel><Ind>USC_17_504@1989-03-01#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
    <on> <Event><Ind>endDamageStatute2</Ind></Event></on>
    <fluent>
        <Situation><Interval>
                <Ind type="&lkif;fee">$500</Ind><Ind type="&lkif;fee">$20,000</Ind>
        </Interval></Situation>
    </fluent>
    <at><Time><Var>T</Var></Time></at>
</Terminates>
```

Reaction RuleML Representation Efficacy Statutory Damage Statute (3)

```
<Initiates  key="#EfficacyStatutoryDamage Statute3"> <!– initiates efficacy fluent damage statute 3-->
    <meta>  <Atom> <Rel>src</Rel><Ind>USC_17_504@1999-12-09#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
    <on> <Event><Ind>startDamageStatute3</Ind></Event></on>
    <fluent>
        <Situation><Interval>
                <Ind type="&lkif;fee">$750</Ind><Ind type="&lkif;fee">$30,000</Ind>
        </Interval></Situation>
    </fluent>
    <at><Time><Var>T</Var></Time></at>
</Initiates>

<Terminates  key="#EfficacyStatutoryDamage Statute1">><!–terminates  efficacy fluent damage statute 3-->
    <meta>  <Atom> <Rel>src</Rel><Ind>USC_17_504@1999-12-09#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
    <on> <Event><Ind>endDamageStatute3</Ind></Event></on>
    <fluent>
        <Situation><Interval>
                <Ind type="&lkif;fee">$750</Ind><Ind type="&lkif;fee">$30,000</Ind>
        </Interval></Situation>
    </fluent>
    <at><Time><Var>T</Var></Time></at>
</Terminates>
```

Reaction RuleML Representation Start/Ende Statutory Damage Statute (1,2)

```
<Happens  key="#StartDamage Statute1"> <!– event start damage statute 1-->
 <meta> <Atom> <Rel>src</Rel><Ind>USC_17_504@1976-10-19#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
     <on> <Event><Ind>startDamageStatute1</Ind></Event></on>
     <at>< Time type="&ruleml;TimeInstant"><Data>1978-01-01</Data></Time></at>
</Happens>

<!– note: this «end» event could be also modeled as a derived event which happens whenever the
    start event of damage statute 2 happens - -->
<Happens  key="#EndDamage Statute1"> <!– event end damage statute 1-->
 <meta> <Atom><Rel>src</Rel><Ind>USC_17_504@1989-03-01#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
     <on> <Event><Ind>endDamageStatute1</Ind></Event></on>
     <at>< Time ><Data> 1989-03-01 </Data></Time></at>
</Happens>

<Happens  key="#StartDamage Statute2"> <!– event start damage statute 2-->
 <meta> <Atom> <Rel>src</Rel><Ind>USC_17_504@1989-03-01#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
     <on> <Event><Ind>startDamageStatute2</Ind></Event></on>
     <at>< Time ><Data> 1989-03-01 </Data></Time></at>
</Happens>
```

Reaction RuleML Representation Start/Ende Statutory Damage Statute (2,3)

```
<!– note: this «end» event could be also modeled as a derived event which happens whenever the
    start event of damage statute 3 happens - -->
<Happens  key="#EndDamage Statute2"> <!– event end damage statute 2-->
 <meta> <Atom> <Rel>src</Rel><Ind>USC_17_504@1999-12-09#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
     <on> <Event><Ind>endDamageStatute2</Ind></Event></on>
     <at>< Time ><Data> 1999-12-09 </Data></Time></at>
</Happens>


<Happens  key="#StartDamage Statute3"> <!– event start damage statute 3-->
 <meta> <Atom> <Rel>src</Rel><Ind>USC_17_504@1999-12-09#title17-chp5-sec504-clsc-lst1-pnt2-subpar2</Ind>
    </meta>
     <on> <Event><Ind>startDamageStatute3</Ind></Event></on>
     <at>< Time ><Data> 1999-12-09 </Data></Time></at>
</Happens>
```

RRML: Satutory Damage Rule

```
<Rule  style="reasoning"  key="#StatutoryDamagesRule"  >
  <if> <And>
      <Atom><Rel iri="&lkif;Infringement">infringes</Rel>
            <Var type="&lkif;infringer">Infringer</Var> <Ind>copyright</Ind>
      </Atom>
      <Atom> <!-- note: could be also modeled as an event-->
            <Rel iri="&lkif;electStatutoryDamages">electStatutoryDamages </Rel>
            <Var type="&lkif;copyrightOwner">CopyrightOwner</Var>
            <Var type="&ruleml;TimeInstant">ElectTime</Var>
      </Atom>
      <Holds> <!– holds efficacy of statutory damages at time ElectTime-->
        <fluent>
            <Interval><Var >MinAmount</Var><Var >MaxAmount</Var> </Interval>
        </fluent>
        <at>< Time ><Var>ElectTime</Var></Time></at>
      </Holds>
    </if>
     <then>
      <Atom>
            <Rel iri="&lkif;payFee">pay Fee</Rel>
            <Var type="&lkif;infringer">Infringer</Var>
            <Var type="&lkif;copyrightOwner">CopyrightOwner</Var>
            <Interval><Var >MinAmount</Var><Var >MaxAmount</Var> </Interval>
      </Atom>
     </then>
</Rules>
```

(Note: other versions of this rule can be marked up with other metadata and qualifications managed in different modules in the knowledge base

Reaction RuleML – Key Message from this Copyright Law example

- Support for **Life Cycle Management**
  - descriptive metadata <*meta*>
  - qualifying metadata <*qualification*>
- Support for Knowledge Representation **Temporal Event/Action Reasoning**
  - Fluents (changeable Situations) <*fluent*>
- Support for **Modularization** and highly efficient **Dynamic Views** on the Knowledge Base
  - **scoped reasoning** <*scope*>
    - global knowledge in the KB becomes closed **local knowledge** in a scope on which reasoning and processing can be done efficiently
    - scopes are at the heart of Reaction RuleML's features for modularization, windowing techniques, transactions, selection and consumption policies, life cycle mangagement, … it is all about **dynamic knowledge**

Pros (and Cons)

- Solution #1
  - No redundancy of the TimeInstant values
  - Definition of external legal temporal parameters of the norm (inforce, efficacy) with metadata and not with <Rel> that can affect the other <Rel> on the internal time of the norm
  - Semplification of the event process model for the legal domain
  - More close to the legal domain terminology and methodology
  - Harmonization with the metamodel
  - Retroactive events and Artifact events
- Solution #2 (Reaction RuleML)
  - Supports conditional and derived events and fluents
  - Different types of events and fluents (e.g.discrete, continous,...) + algebra operators
  - Different types of relations for events over time (occurs, planed ...)
  - Timepoint and Timeinterval semantics for fluents
  - Allows variables for events, times, fluents
  - Definition of changeable legal temporal parameters as fluents
  - Builds on established research and syntax in AI temporal event/action logics for reasoning on their effects (past, current, and future/planned)
  - Supports modularization, dynamic views and life cycle management of dynamic knowledge

Conclusion and Future plans

- Next topics in the agenda:
  - Finalize the temporal model
  - Jurisdiction
  - Deontic operators
  - Meta-rules

- Within November submit the first outcome to the Public Review
- We need your contributions for achieving the goals
- It is possible to contribute in three ways:
  - Join to the TC in OASIS
  - Contribute externally outside to OASIS
  - Annual Face2Face meeting

Thank you for your attention!

and joint to LegalRuleML TC