

# Representing Roles in Formalizing Domain Ontology for Land Administration

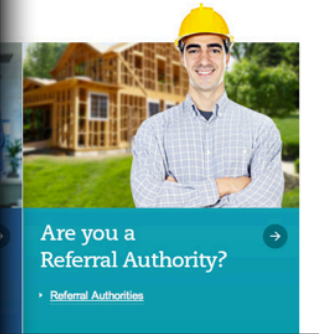
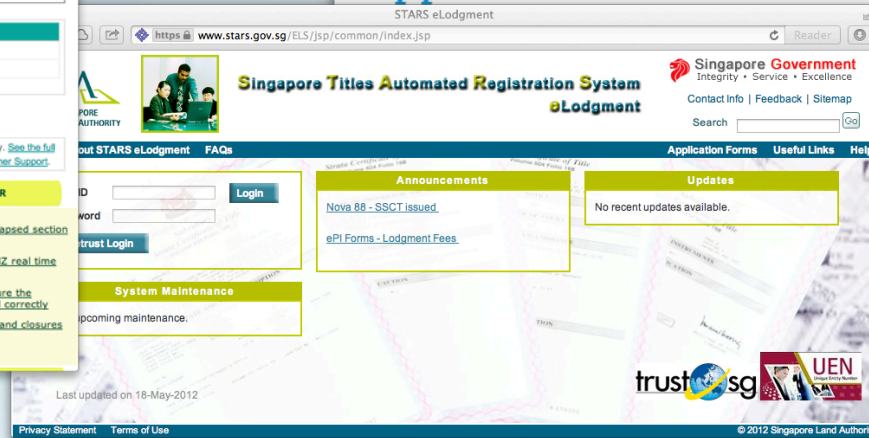
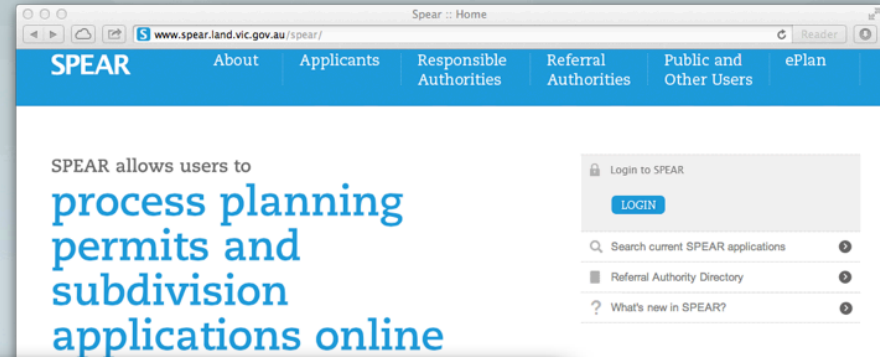
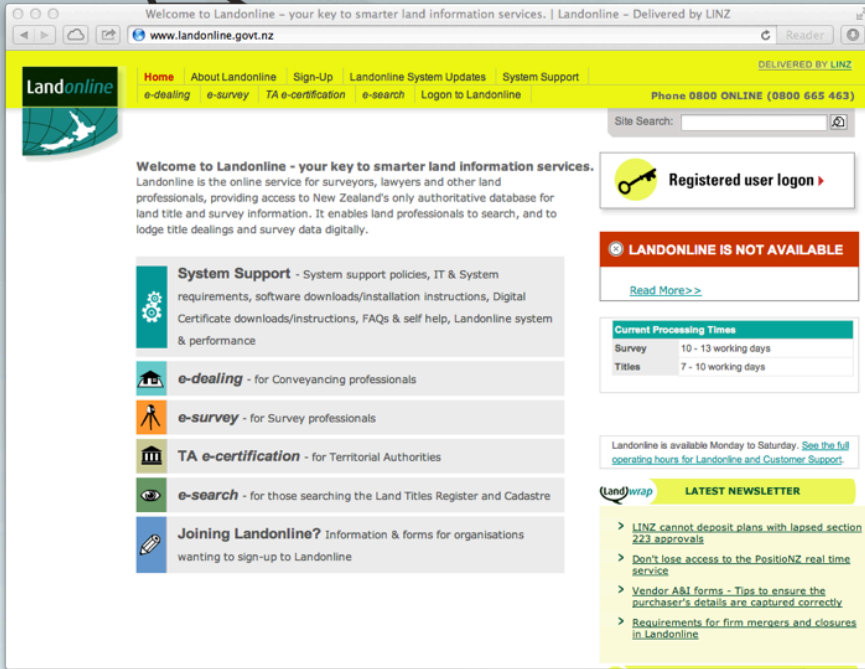
**Kean Huat SOON**

*International FIG Workshop on Land Administration Domain Model (LADM)*

# Outline

- Background
- Objectives
- Formalization
- Role Representation
- Application
- Conclusions & Future Work

# Portals



- various and large customers include surveyors, lawyers, government authorities, the public, landowners, etc.
- the customers are core to the portals and operations
- being able to identify user role intelligently will allow selected information to only be provided to relevant customers

# Formal Ontology

- formal ontology offers logical facts and rules for automated checking on integrity and consistency of data
- a formal ontology that emphasizes roles helps intelligently identify user roles based on information received, for example:

```
Party(?x) ^ possesses(?x, ?y) ^ SpatialSource(?y) ^  
(hasRRR=0) (?x) -> Surveyor(?x)
```

a party who possesses spatial source (e.g. certified plan) and does not have any related RRR can be inferred as a surveyor

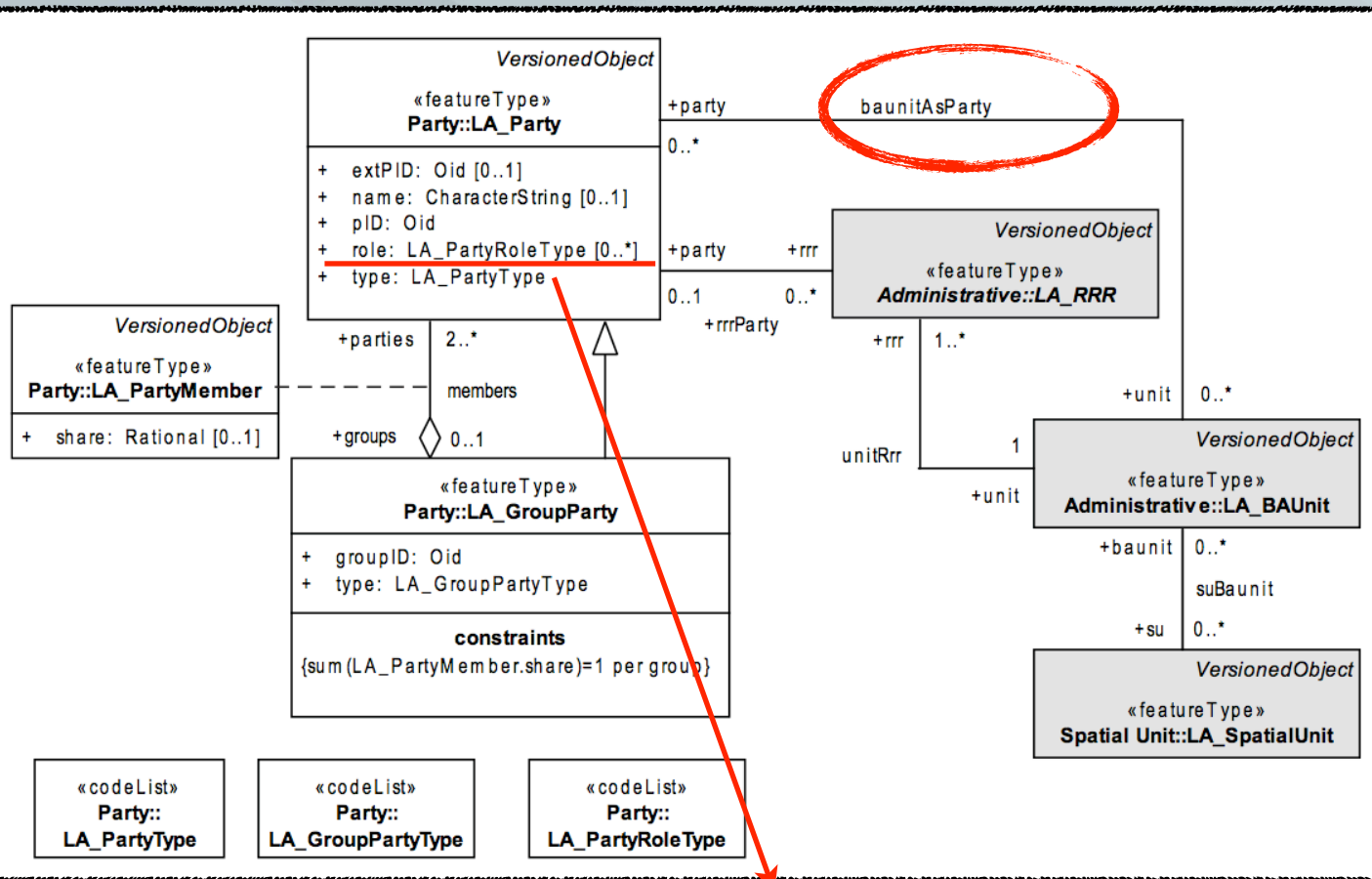


# Objectives

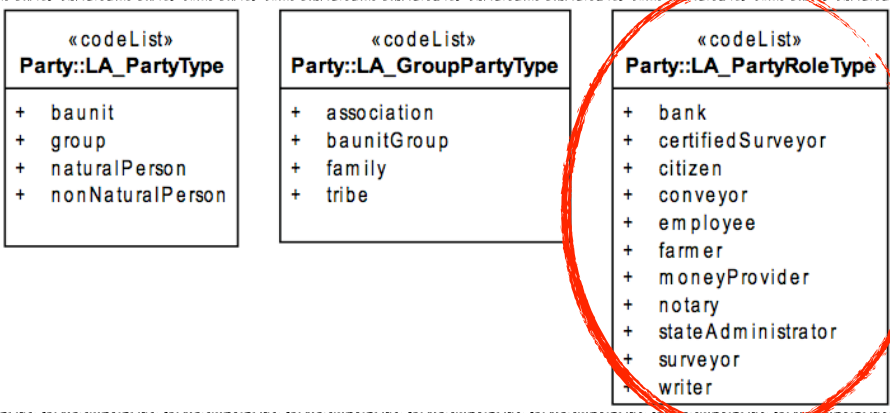
- to formalize domain ontology for land administration in OWL (Web Ontology Language)
- to add role representation, which captures user roles and their relationships, in the ontology



# Not Part of the Existing Model



BAUnit and Party have a role relationship, but baunitAsParty is treated like other association relationships (e.g. unitRrr, suBaunit)



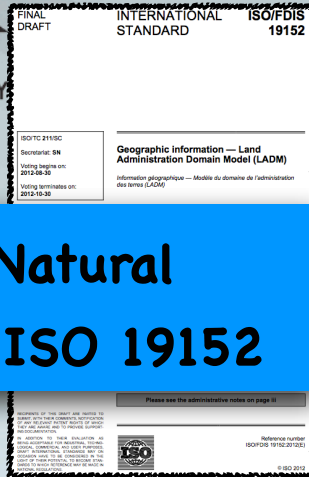
## Role as CodeList

1. limits the representation of role as context dependent;
2. assumes the conceptual structure of role is flat, but role structure is much complex

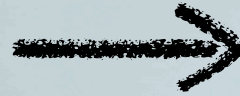
# Methodology

- to treat roles as a first class concept. Treating roles as concept allows flexible definition of role to be context dependent;
- BAUnit is treated as RolePlayer to relate to Party, which is a subclass of Role through hasRole relationship;
- Role is represented in hierarchy or ontology in its own.
- introducing three concepts: **RolePlayer**, **Role** and **Context**, and two relationships: **hasRole**, **dependsOn**

# Overall Process of Formalization



Extracting Natural Texts from ISO 19152



```
.....  
.....  
Declaration ((ObjectProperty (:hasRight)))  
ObjectPropertyDomain (:hasRight :Party)
```

Drafting the Functional Syntaxes



LADMontology (http://wiki.tudelft.nl/pub/Research/ISO19152/ImplementationMaterial/LADMontology.owl) : [Users/keanhuatsoon/ontologies/LADMontology/LADMontology.owl]

Active Ontology | Entities | Classes | Object Properties | Data Properties | Individuals | OWL Viz | DL Query | OntoGraf

Class hierarchy: VersionedObj

- Thing
  - VersionedObject
    - BAUnit
      - BasicPropertyUnit
      - LeasedUnit
      - RightOfUseUnit
    - BoundaryFace
      - BoundaryFaceString
    - Context
      - AdminSource
      - SpatialSource
    - Level
    - Party
      - Citizen
      - Conveyancer
      - Employee
      - Farmer

Object property hierarchy:

- topObjectProperty
  - containsOtherGroupPa
  - dependsOn
  - describesBFace
  - describesBFaceString
  - describesPoint
  - describesSpatialExtent
  - hasAdminSourceBAUnit
  - hasAdminSourceParty

Web Ontology Language (OWL)

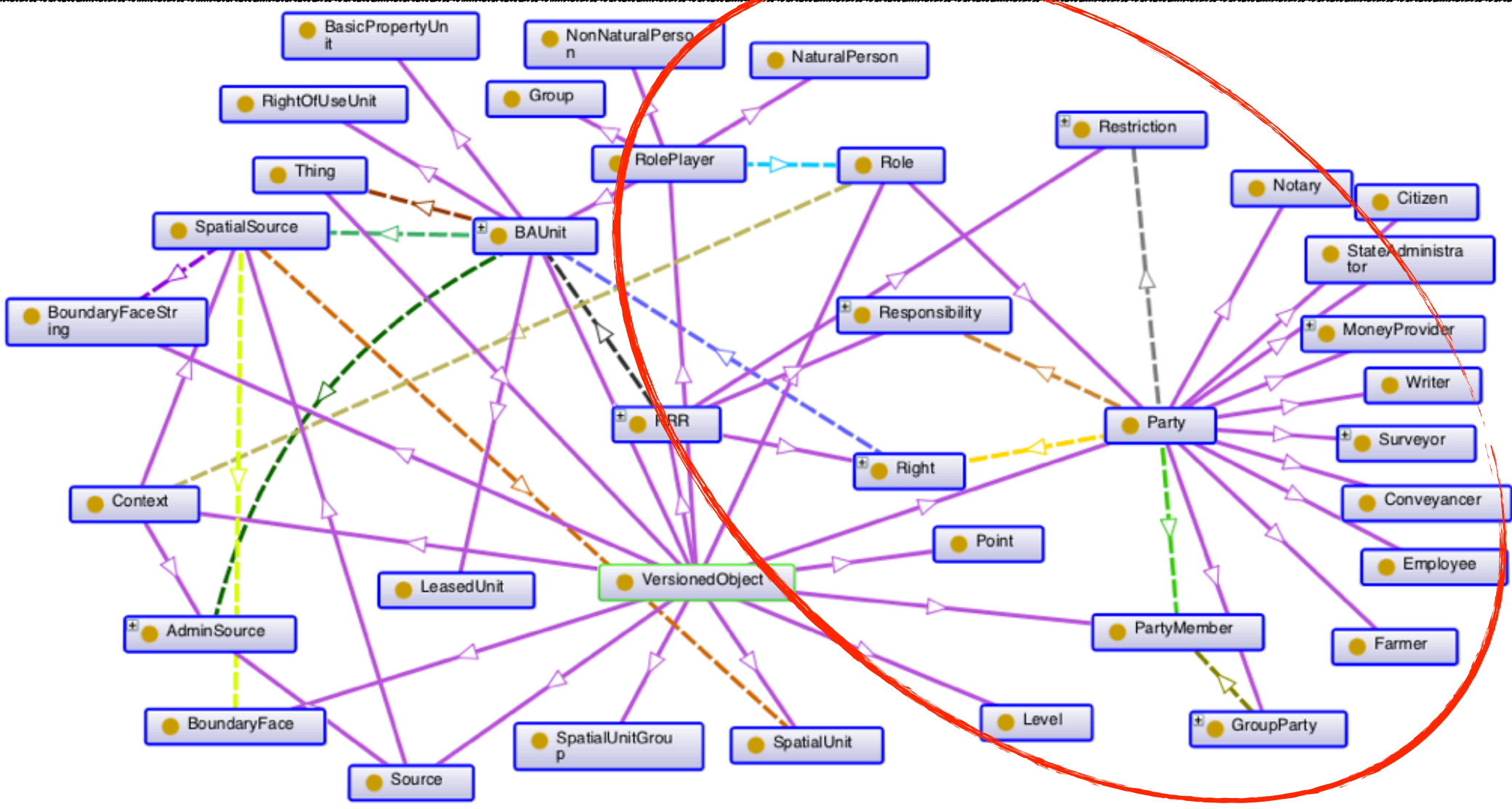
```
<rdf:RDF xmlns="http://wiki.tudelft.nl/pub/Research/ISO19152/ImplementationMaterial/LADMontology.owl/#"  
.....  
.....>
```

Building Ontology in Protege, an Ontology Editor

To use the reasoner click Reasoner->Start reasoner  Show Inferences



# Resulted Formal Ontology in OWL



# Classes and Properties

- ▼ ● VersionedObject
  - ▼ ● BAUnit
    - BasicPropertyUnit
    - LeasedUnit
    - RightOfUseUnit
    - BoundaryFace
    - BoundaryFaceString
    - ▼ ● Context
      - AdminSource
      - SpatialSource
    - Level
    - ▼ ● Party
      - Citizen
      - Conveyancer
      - Employee
      - Farmer
      - ▼ ● GroupParty
        - Association
        - BAUnitGroup
        - Family
        - Tribe
      - ▼ ● MoneyProvider
        - Bank
        - Notary
        - StateAdministrator
      - ▶ ● Surveyor
      - Writer
    - PartyMember
    - Point
    - ▼ ● Role
      - ▶ ● Party
    - ▼ ● RolePlayer
      - ▶ ● BAUnit
      - Group
      - NaturalPerson
      - NonNaturalPerson
    - ▼ ● RRR
      - ▶ ● Responsibility
      - ▶ ● Restriction
      - ▶ ● Right
    - ▼ ● Source
      - AdminSource
      - SpatialSource
    - SpatialUnit
    - SpatialUnitGroup

- containsOtherGroupParties
- dependsOn
- describesBFace
- describesBFaceString
- describesPoint
- describesSpatialExtent
- hasAdminSourceBAUnit
- hasAdminSourceParty
- hasAdminSourceRRR
- hasBASpatialUnit
- hasBAUnitAdminSource
- ▼ ● hasBAUnitRRR
  - hasBAUnitResponsibility
  - hasBAUnitRestriction
  - hasBAUnitRight
- hasBAUnitSpatialSource
- hasMortgage
- hasMortgageRight
- hasPartyMembers
- hasRequiredRelationshipBAUnit
- hasResponsibilityParty
- hasRestrictionParty
- hasRightParty
- ▼ ● hasRole
  - ▼ ● hasRRR
    - hasResponsibility
    - hasRestriction
    - hasRight
  - ▼ ● hasRRROnBAUnit
    - hasResponsibilityOnBAUnit
    - hasRestrictionOnBAUnit
    - hasRightOnBAUnit
- hasSpatialSourceBAUnit
- hasSpatialSourceParty
- isRegisteredAs
- isSupportedBy

# Ontology available at LADM Wiki

SLA

ImplementationMaterial < Research/ISO19152 < TuDelft

wiki.tudelft.nl/bin/view/Research/ISO19152/ImplementationMaterial

TU Delft Delft University of Technology

Jump Search

TuDelft > Research/ISO19152 Web > ImplementationMaterial (13 Aug 2013, PeterVanOosterom) PDF Raw edit Edit Attach

Tags:  create new tag, view all tags

## LADM implementation material

Note: also (open source) implementation material could be added (software) here.

### Implementation Activities

- **LADMontology.owl: Representing Roles in Formalizing Domain Ontology for Land Administration** (to be presented by Kean Huat Soon at the International FIG workshop on the Land Administration Domain Model 24-25 September 2013, Kuala Lumpur, Malaysia)
- UN Habitat Social Tenure Domain Model (STDM), a pro-poor land rights recording system.
- UN FAO Open Source Software Project - FLOSS Solutions for Open Land Administration (SOLA). LADM is the starting point for this software. Enterprise Architect file within the documents on <http://www.flossola.org>.
- [Example\\_Implementation\\_LADM.pdf](#): IT System Specification. Example Implementation LADM (Jan van Bennekom-Minnema, COWI A/S, Department: Surveying and Land Administration), draft 25 March, 2011.
- Addis Ababa: The Road Map to Progress through Securing Property Rights with Real Property Registration System by Tarek Zein (Hansa Luftbild) and Zerihun Amdemarian Berisso (City Administration of Addis Ababa), World Bank conference, April 2012, [http://www.landandpoverty.com/agenda/pdfs/paper/zein\\_full\\_paper.pdf](http://www.landandpoverty.com/agenda/pdfs/paper/zein_full_paper.pdf)

### Attachments

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Topic revision: r6 - 13 Aug 2013 - 13:22:28 - PeterVanOosterom

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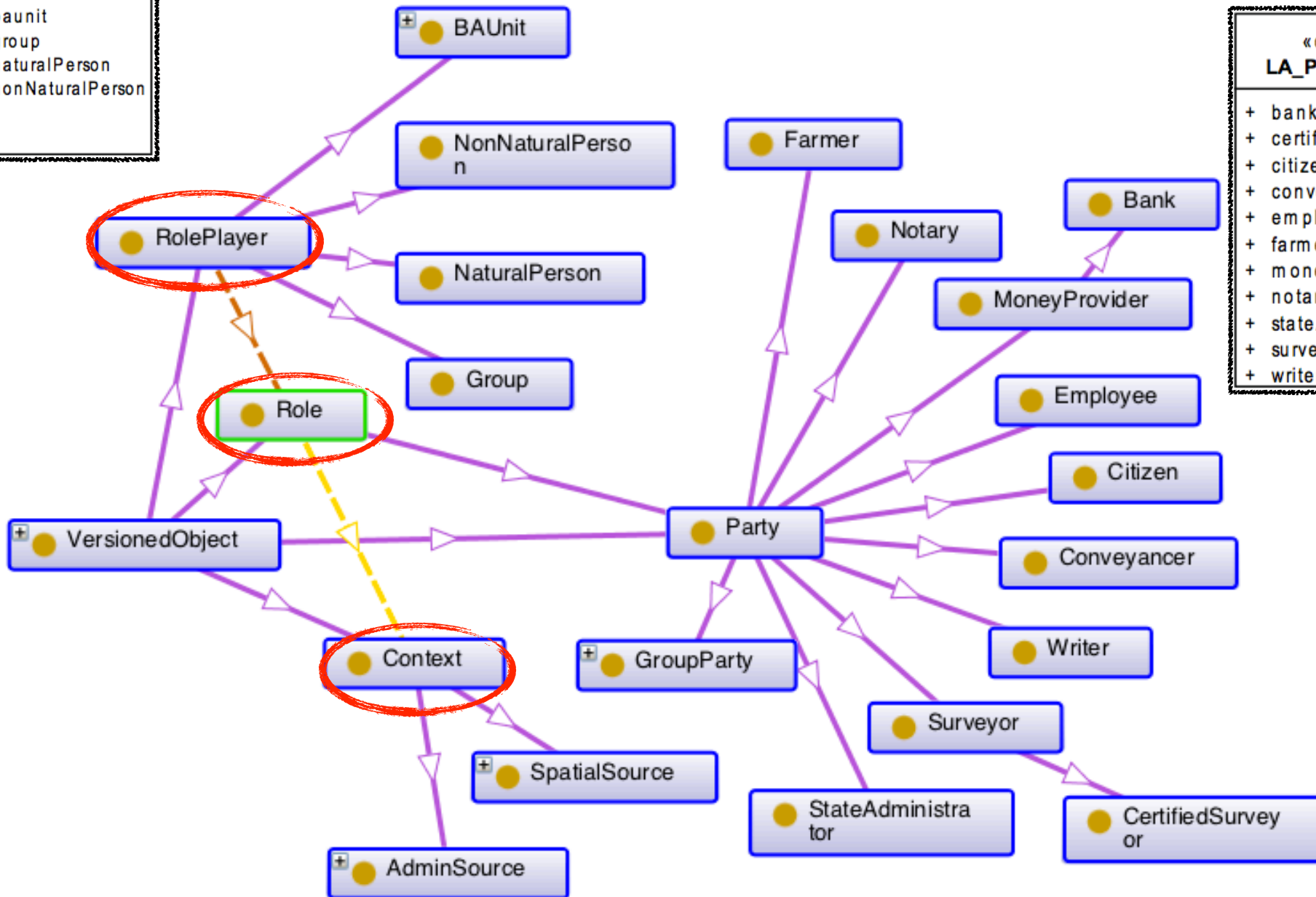


# Role Representation

SLA

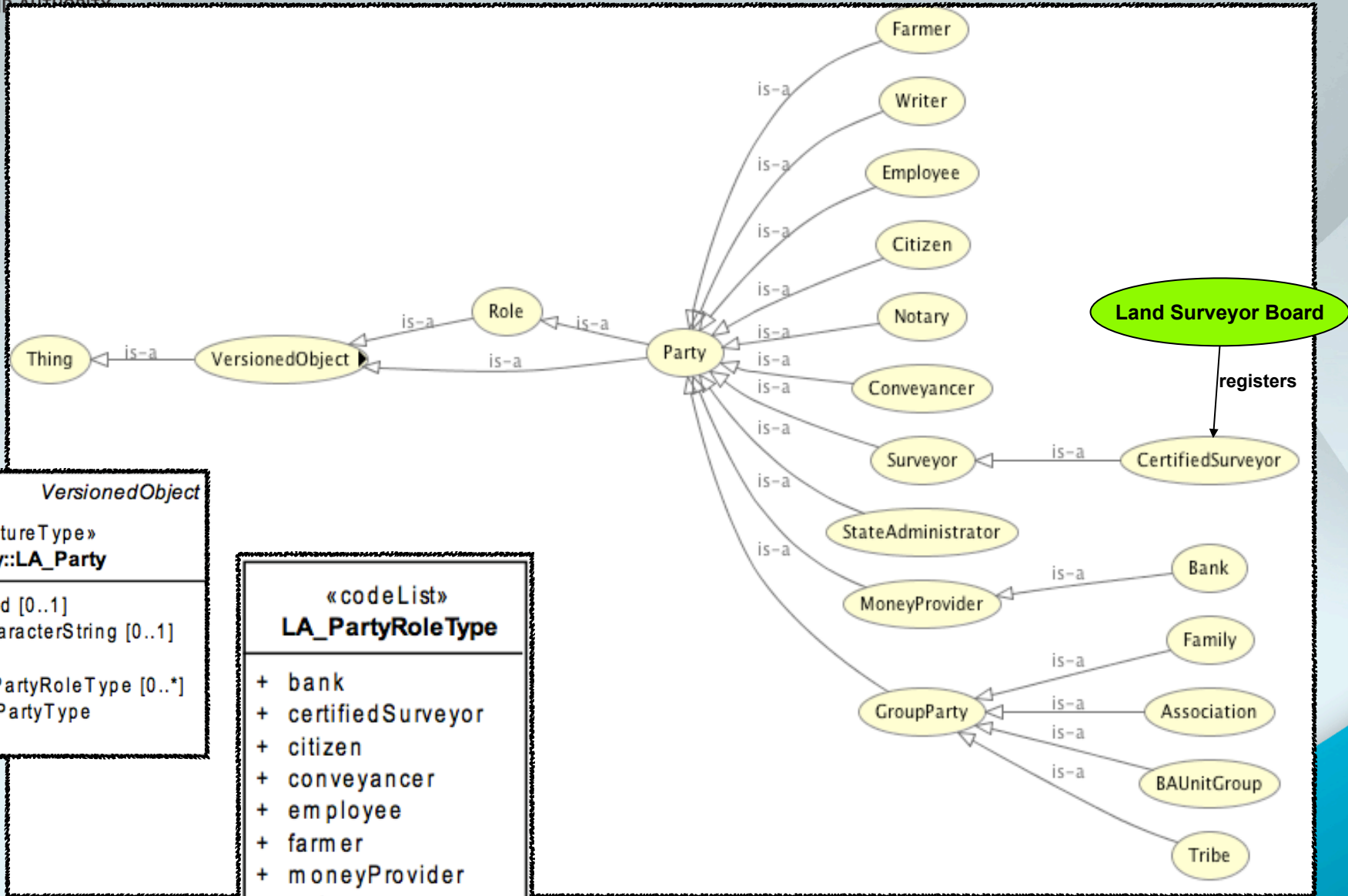
«codeList» LA_PartyType	
+	baunit
+	group
+	naturalPerson
+	nonNaturalPerson

«codeList» LA_PartyRoleType	
+	bank
+	certifiedSurveyor
+	citizen
+	conveyancer
+	employee
+	farmer
+	moneyProvider
+	notary
+	stateAdministrator
+	surveyor
+	writer





# Context Dependent Role



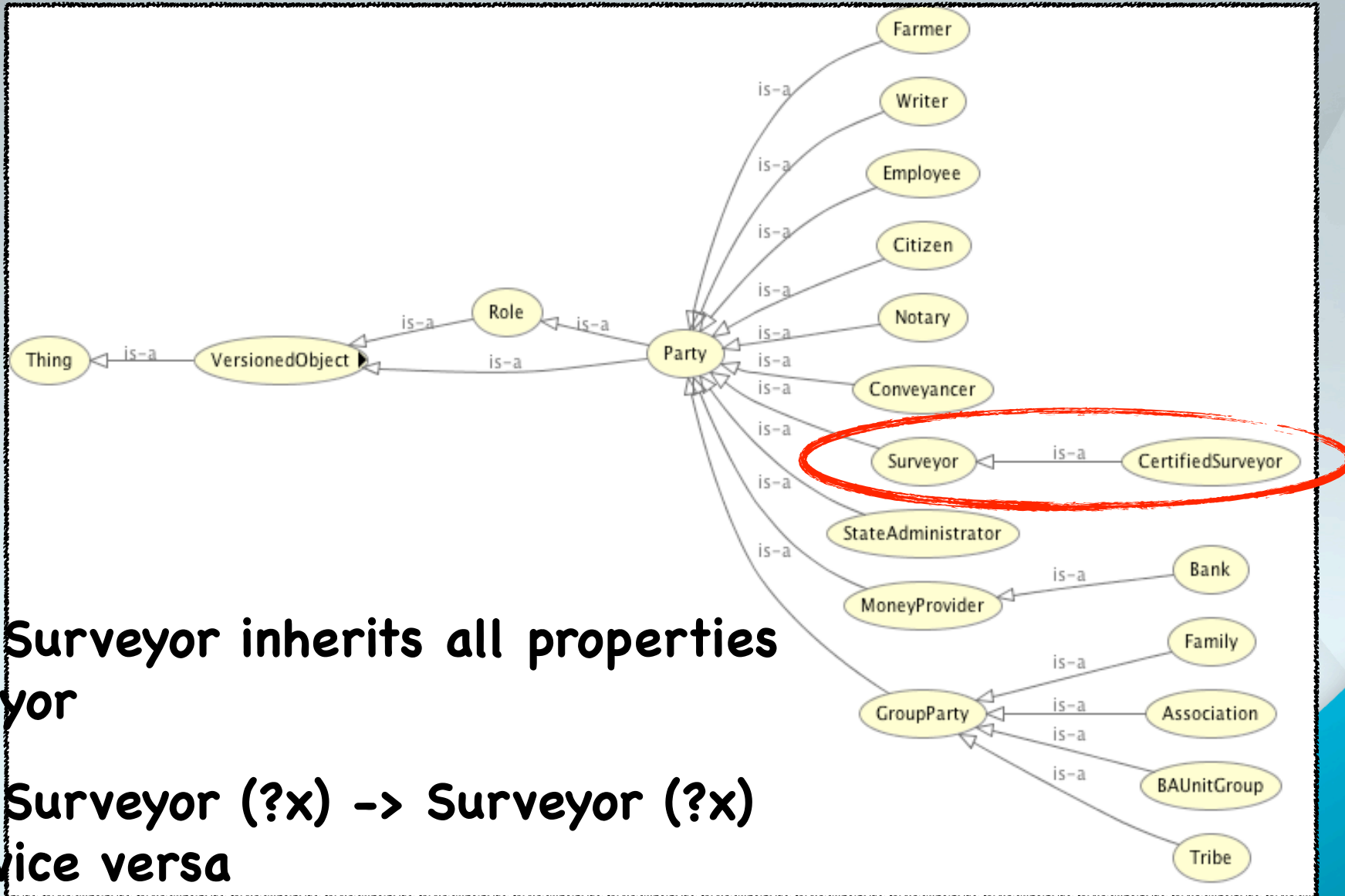
```

VersionedObject
«featureType»
Party::LA_Party
+ extPID: Oid [0..1]
+ name: CharacterString [0..1]
+ pID: Oid
+ role: LA_PartyRoleType [0..*]
+ type: LA_PartyType
    
```

```

«codeList»
LA_PartyRoleType
+ bank
+ certifiedSurveyor
+ citizen
+ conveyancer
+ employee
+ farmer
+ moneyProvider
+ notary
+ stateAdministrator
+ surveyor
+ writer
    
```

# Define Roles in Hierarchy

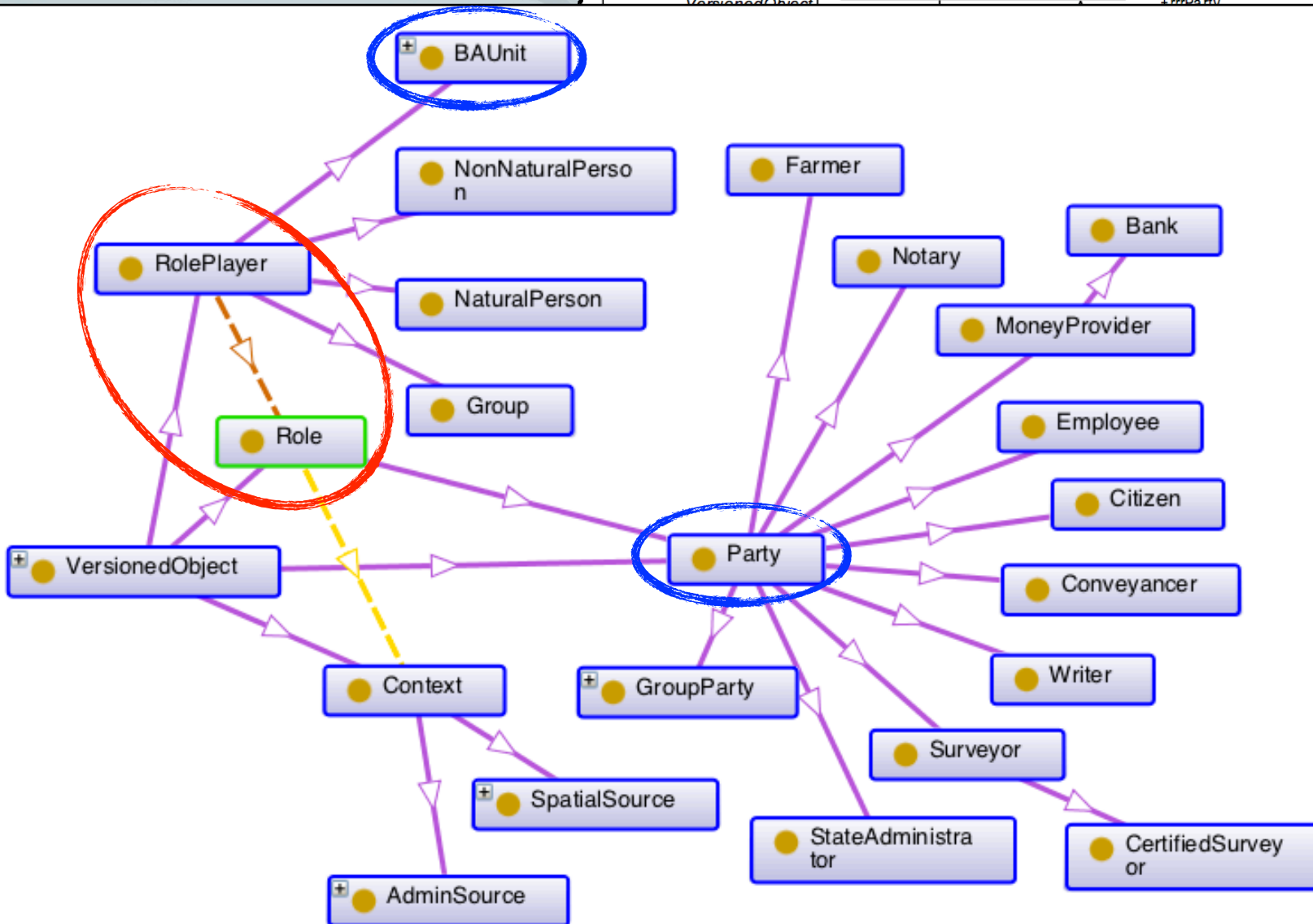
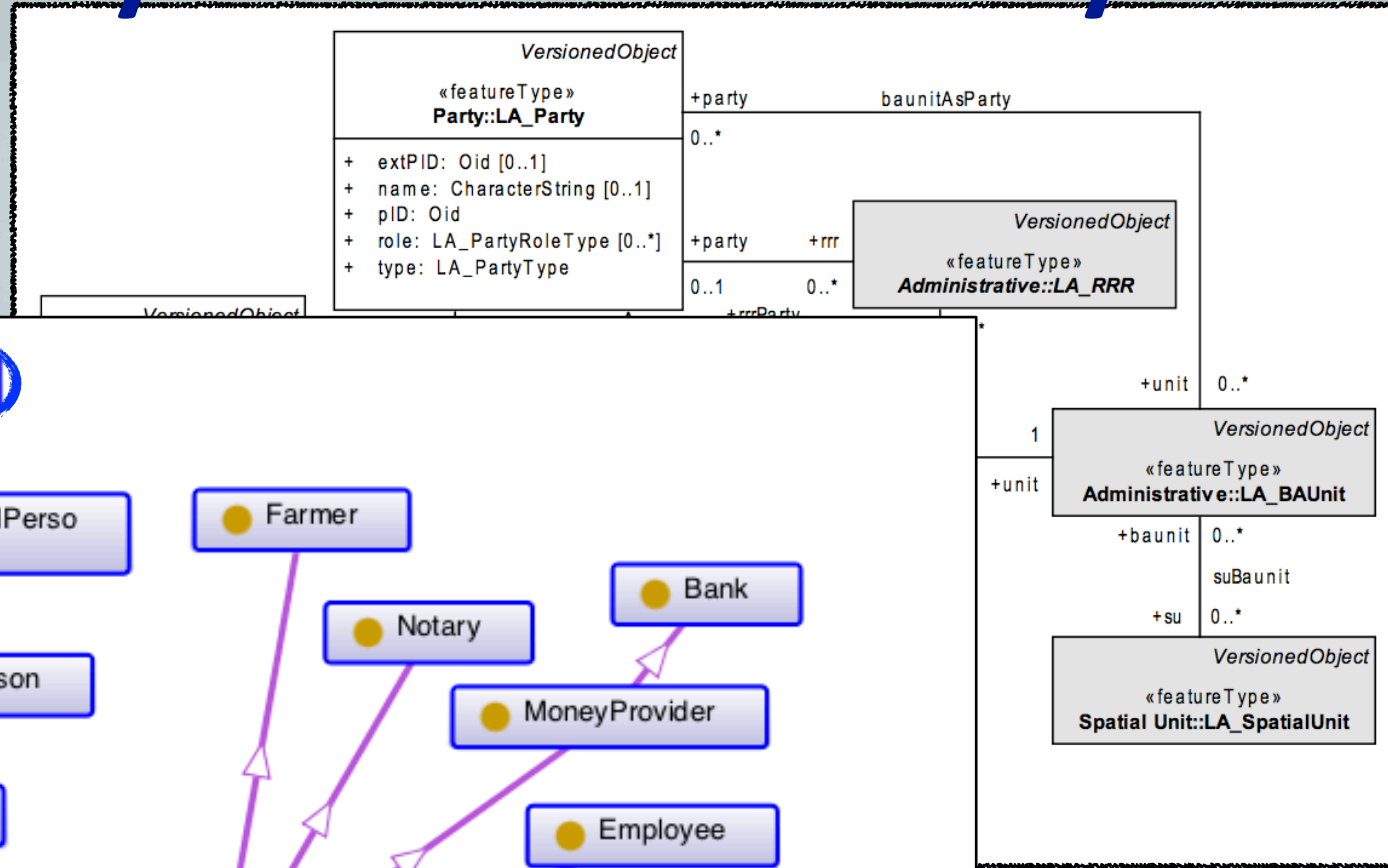


- certifiedSurveyor inherits all properties of Surveyor

- certifiedSurveyor (?x) -> Surveyor (?x) but not vice versa

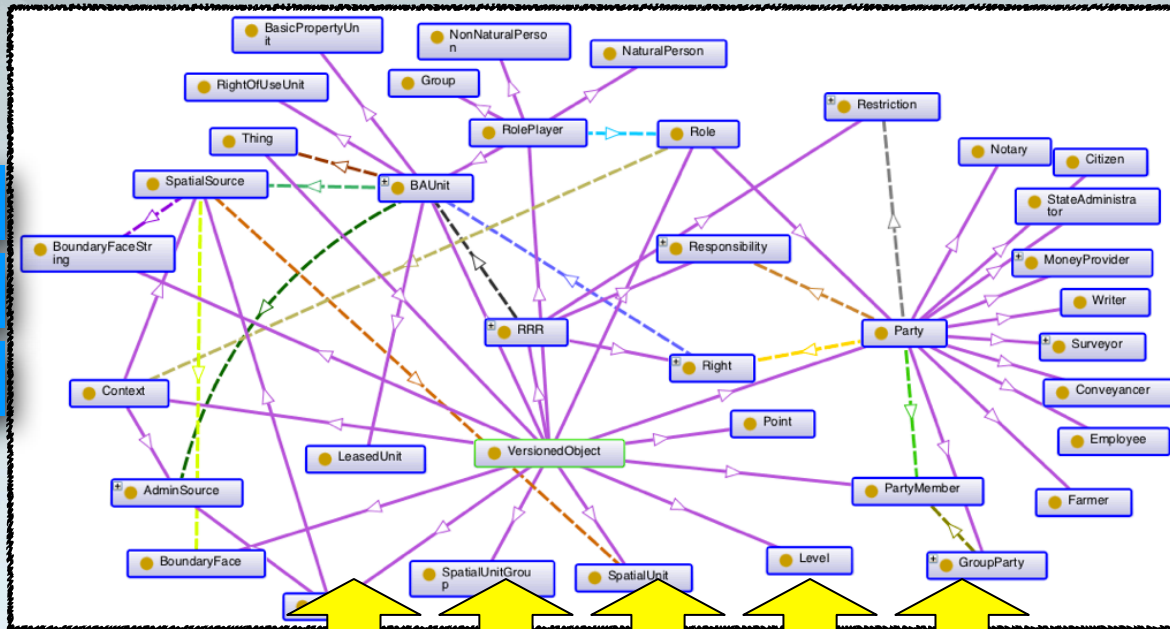
- the hierarchy can be an ontology in its own with rules

# “BAUnit plays the Role of Party”

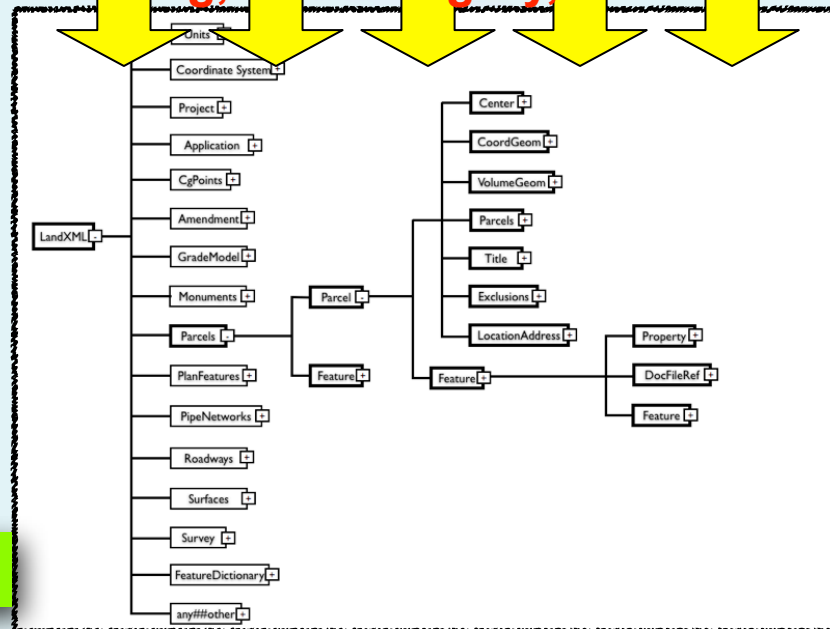


# Potential Application in Cadastral Processing

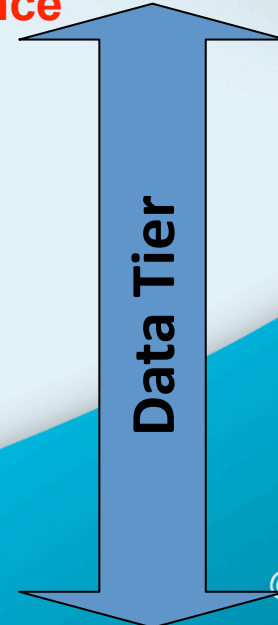
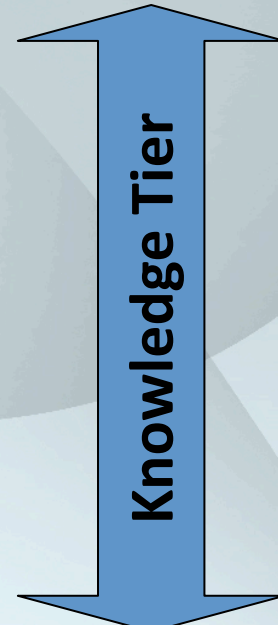
OWL  
SWRL/RIF  
Reasoning



Consistency Checking, Data Integrity, User Role Inference



LandXML





# Conclusions

- formalized domain ontology from natural language to OWL
- enhanced the ontology with the representation of user roles
- the role representation allows:
  - to describe roles as context dependent
  - to represent roles in hierarchy or ontology in its own
  - to treat the role relationship between BAUnit and Party more specific

# Future Work

- temporal aspect was not considered in the ontology, temporal constraints and relationships should be added
- the role representation should be enhanced with more concepts and relationships and be supported with logical rules, using SWRL or RIF
- for further improvements, value the inputs from the LA community on the ontology at the LADM wiki <http://wiki.tudelft.nl/pub/Research/ISO19152/ImplementationMaterial/LADMontology.owl>

# Thank You!

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