The Model Driven Architecture Approach applied to the Land Administration Domain Model

With focus on constraints specified in the Object Constraint Language

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FIG Working Week Integrating Generations   Stockholm, Sweden 14-19 June 2008   1

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Presentation Summary

- **The Land Administration Domain Model - 1.1**
- Integrated country profile
- Applying the MDA approach to LADM
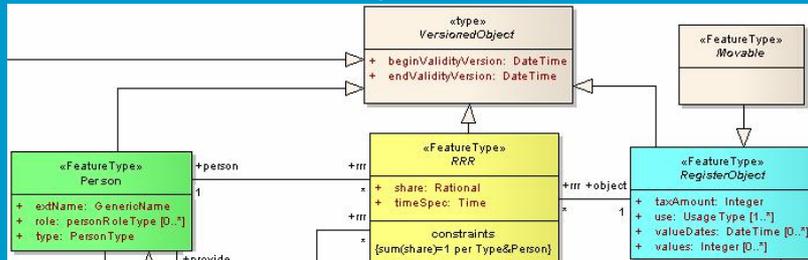- Object Constraint Language (OCL)

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Land Administration Domain Model

- LADM based on the Cadastre 2014 vision
- LADM aims to support:
  - Cadastral systems development based on a MDA
  - Enabling communication between involved parties, based on the shared ontology

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LADM: Changes on version 1.1

- Use of INSPIRE Generic conceptual model elements
- Inclusion of the LegalNetwork class
- Sub-classes with no specific properties were integrated in parent class
- Full compliance with ISO19107 spatial schema

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LADM version 1.1 Diagrams (1)

- Person, Right-Restriction-Responsibility and Register Object inherit from the VersionedObject

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LADM version 1.1 Diagrams (2)

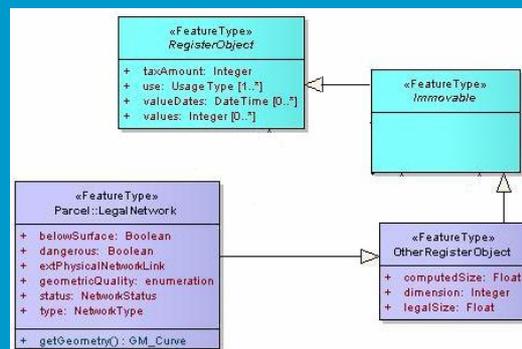- The LegalNetwork class and its associations

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LADM-PT: Integrated Country Profile

- Context
  - Research - TUDelft PhD
  - Case Study of Land Administration in Portugal
  - Example of how the LADM understanding / communication / efficiency / development goals can be attained by implementing it into a specific country profile
- The Model-Driven Architecture approach
  - UML Model.

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Applying the MDA approach to LADM-PT

LADM as a Platform Independent Model (PIM)

- conveys the basic ontology of the domain
- supplying a generic blueprint that can be adapted, while carefully considering a number of requirements:
  - Existing technologies and extent of cadastral coverage
  - Surveying and mapping regulations
  - Institutional settings
  - Legal and regulatory framework

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Country Profile Model Transformations

LADM to LADM-PT Model Transformation

- PIM transformation -> the resulting country profile LADM-PT is still platform independent.
- UML Profile mechanism applied to a prototype; implementation of spatial objects into a number of existing spatial databases.
- UML standard mechanisms such as stereotypes, tags and class specializations

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Integrating the Legal Domain

Specializations of the RRR Super-class

- LADM-PT Legal Package: the RRR abstract super-class is called "Forms of Property"
- Focus on the private property which can be registered at the Land Registry
- Horizontal Property Right

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The Horizontal Property Right on LADM-PT (1)

Diagram 1:
Horizontal Property
as a "Right of Use"

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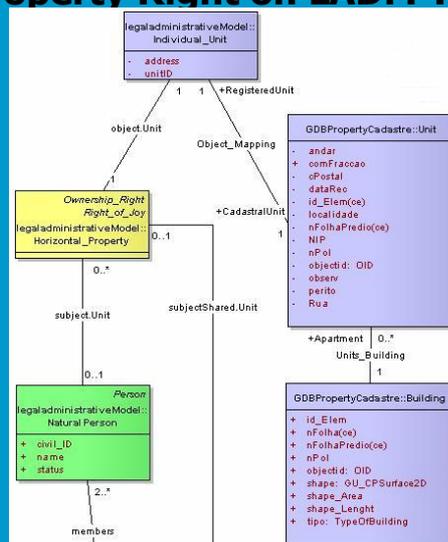
The Horizontal Property Right on LADM-PT (2)

Diagram 2: Common_parts as a "Common Right"
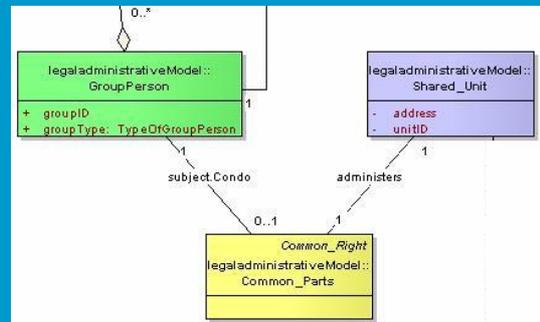
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A CASE tool to support the MDA approach

Generic aims of the CASE tool
- Support development implementing a specific LADM Country Profile
- Model Transformation from a country PIM to a Platform Specific Model (PSM)
- Model constraints defined in Object Constraint Language (OCL)

Model Transformations
1. Country profile UML Model PIM to a PSM
2. Generation of a database schema

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CASE Tool Development Choices

- Open Source, Eclipse based framework
- Enterprise Architect SDK

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Model Transformation examples

- Generating a PSM for the LADM Survey package
  1. SurveyPoint Quality as «enumeration»
  2. SurveyDocumentType as a «CodeList»
  3. SurveyPoint spatial attributes with ISO type GM_POINT
  4. SourceDocument and specializations LegalDocument and SurveyDocument

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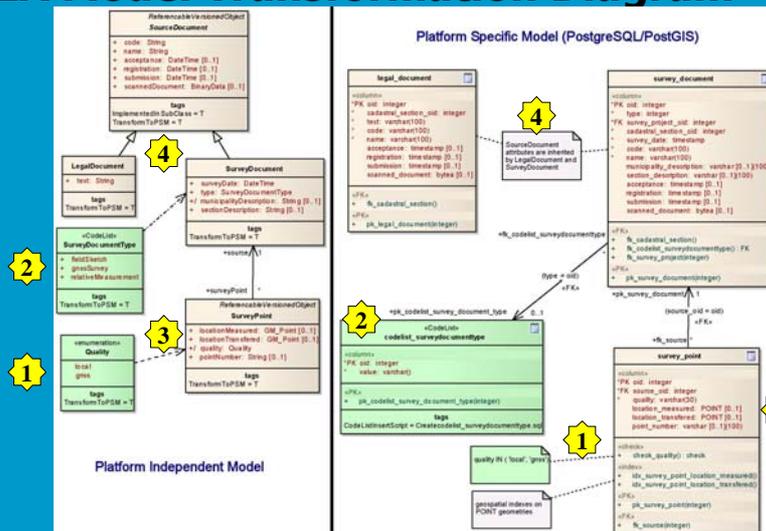TUDelft

EA Model Transformation Diagram

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- **Object Constraint Language (OCL)**

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OCL support in the MDA approach

- Nature of the Object Constraint Language
- Current shortcomes of existing modelling software

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OCL examples in LADM and LADM-PT

- LADM Legal package; share constraint on RegisterObject

  context RegisterObject

  inv SumOfShares: self.RRR. share->sum()=1

- LADM Survey package

  context SurveyPoint

  inv distanceMeasuredTransferred :

  ST_Distance(self.locationMeasured, self.locationTransferred) < 5

- LADM-PT Legal package; Horizontal Property diagram

  context GroupPerson

  inv: self.groupType = TypeOfGroupPerson::Condominium implies

  self.common_Parts → notEmpty()

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OCL support on the EA Prototype

- Model Transformation example: PIM OCL → PSM^2

  - From the Survey package (PIM)

  context SurveyPoint

  inv distanceMeasuredTransferred :

  ST_Distance(self.locationMeasured, self.locationTransferred) < 5

  - To the PSM^2 (after 2nd transformation)

  <<check>>

  + check_distance_measured_transferred( ) : check

  - Final implementation on PostgreSQL/PostGIS

  ALTER TABLE survey_point ADD CONSTRAINT

  Check_distancemeasured_transferred CHECK (

  ST_Distance(location_measured, location_transferred) ≤ 5);

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Conclusions and Recommendations (1)

- Advices on the derivation of a country profile
  - Gather country specific information on each of the LADM package-related domains;
  - Legacy data models are most useful when depicted in UML; current MDA reverse engineering offers such capabilities;
  - Start looking for (quasi) complete matches on core object classes; Some LADM classes could be omitted and new specialized classes can be defined;
  - Packages should be developed iteratively by multi-disciplinary teams (namely lawyers, surveyors and computer experts).

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Conclusions and Recommendations (2)

- Potential benefits from CASE tool implementations
  - Provide an Abstraction Layer supplying additional capabilities;
  - Fully automatic conversion was achieved in a prototype, from a UML PIM to a PsotgreSQL database;
- Extending the CASE tool to support OCL (further research needed)

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Questions?

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