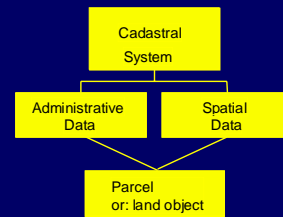## Further Progress in the Development of the Core Cadastral Domain Model

Cadastral Model

Christiaan Lemmen, Paul vander Molen – Kadaster, NL
Peter van Osterom, Jaap Zevenbergen and Wilko Quak – Delft University

FIG • ITC • TUDelft Delft University of Technology

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Cadastral System

Administrative Data | Spatial Data

Parcel or: land object

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## Standards

- There are supposed to be huge differences between cadastral and land registry systems
- Look to the common area's:
  - Standardised Model
  - Avoid re-inventing the wheel
  - Enable involved parties to communicate

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## Standards

- Many countries want to computerise their cadastral data sets: modelling is complex
- There are problems in data dissemination into and from a distributed enviroment which is a condition in case data are maintained by (many) different organisations
- Lack of a shared set of concepts and terminology

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## Technology push vs. Market pull

- Geo-ICT developments: Modeling standards, Database technology, Positioning systems, Internet development, Wireless communication
  → Geometry accepted in mainstream ICT

- User requirements of Cadastral systems change over time, due to: Change in legislation, Governmental policy, New tasks for the organization, New technology

- Therefore, generic and flexible systems needed →
  Model Driven Architecture based on conceptual models described in UML

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## Proposal (FIG Washington 2002)

- Develop standard Core Cadastral Domain Model, including:
  - Spatial part (geometry, topology)
  - Extensible frame for legal/admin part
  - Based on core object-right-subject model
- Object-orientation → express in UML
- Accepted by large community: FIG, OGC, ISO, user support, this means it can be **adapted by the industry**
- Maximize co-operation, minimize double effort

FIG • ITC • TUDelft

## Cadastral Data

- object (parcel, apartment, spatial unit)
- right (ownership (...,...,...), usufruct, mortgage, restriction, informal, unknown, conflict...)
- person (natural, non natural, group)
- identifiers
- value
- Area (GIS area and legal area)
- classification
- geographic name
- person name
- date (birth, establishment, acceptance, transaction, survey, check-in)
- ranking order

- source document
- forms
- point
- boundary
- face, edge, node: topology
- GIS Layers
- apartment - 3d
- land use
- share
- transaction type
- purchase price
- history (check-in, check-out, mother-child, history class)
- right relation
- mortgage, interest

## Cadastral Update Process Data

- Transactions
- Customers request (application)
- Quality (accuracy, reliability, collection mode)
- Name of Conveyor, Surveyor, etc
- Signature
- Process step
- Archive data in use
- Next open identifier
- Type of instrument
- Distance in km
- Letters to buyer and seller
- Car in use, fuel
- Date and time
- Site
- Buyer/seller do not agree
- Authorisation
- Computer availability

- Topological erros
- Production norm
- Time registration
- Objection, complaint
- Salary scale
- Team
- Teammembers
- Responsible manager
- Status code
- Out of tolerance
- Line code
- Point code
- Transformation parameters
- Historical data used
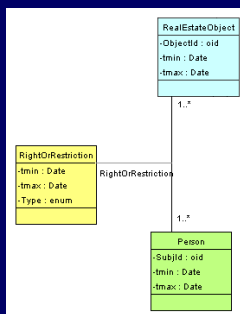- Cluster identifier
- IT Support

## Basic datamodel

1. Parcel
2. Apartment
3. Building
4. Spatial Unit

One Point
Lines
Polygon (low accuracy)
Polygon (high accuracy)

Quality labels

1. Formal Ownership
2. Customary
3. Indigenous
4. Tenancy
5. Starter, landhold, freehold
6. Possession
7. Mortgage
8. Usufruct
9. Long Lease
10. Restriction Type 1
11. Restriction Type 2
12. State
13. Informal
14. Unknown
15. Disagreement
16. Occupation
17. Uncontrolled privatisation
18. **Conflict**

Overlap

1. Natural Person
2. Company
3. Municipality
4. Co-operation
5. Group
6. Ministry

Biometric identification

CONTINUUM OF RIGHTS

Legal or formal rights

Registered freehold
Leases
Group tenure
Adverse possession
Anti evictions
Occupancy
Customary

Perceived tenure approaches:
- Political statements
- Services without legal tenure

Illegal or informal rights

## Model basis: Object-Right-Subject

RealEstateObject
-ObjectId : oid
-tmin : Date
-tmax : Date

1..*

RightOrRestriction
-tmin : Date
-tmax : Date
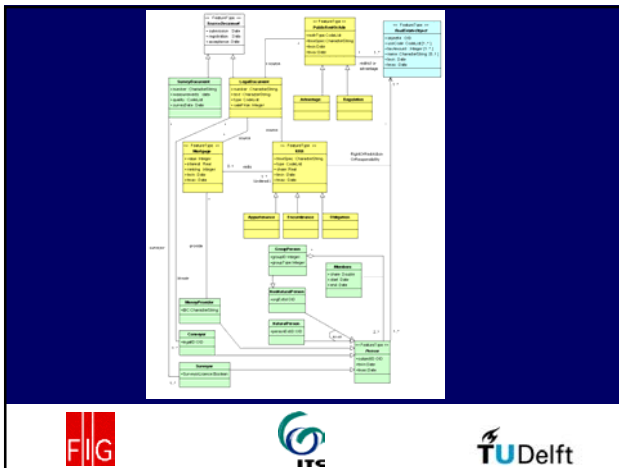-Type : enum

RightOrRestriction

1..*

Person
-SubjId : oid
-tmin : Date
-tmax : Date

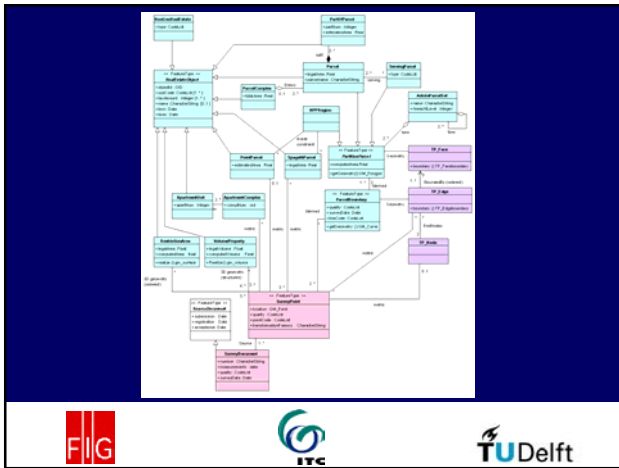## Core Cadastral Domain Model: Geometry

- Real estate object with specialisations, e.g. parcel, parcel-complex, volume property, restriction area, point parcel, apartment unit
- Agregations like parcels set, parcel complex, apartment complex
- Link to surveying and survey documentation
- Link to OGC standards (Nodes, Edges and Faces)

## Core Cadastral Domain Model: Legal-administrative

- RRR is an association class between Person and RealEstateObject
- Mortgage, restriction and RRR are based on legal documents or decisions
- Person are specialised as natural or non natural
- Surveyor, conveyor and money provider are included, specialisations of the Persons class
- A RRR can be temporal



## Cadastre 2014 approach is integrated

- 2014 s a generic, abstract set of guidelines
- CCDM is refined into a more specific model, for implementation

## Boundary of the system – outside (in this moment):

- Spatial reference system
- Ortho photo, satellite, Lidar
- Topography
- Geology, geo-technical, soil
- Pipelines and cables
- Addresses (postal codes)
- Building registers
- Natural person registers
- Non-Natural person registers
- Polluted area registers
- Mining right registers
- Cultural history
- (Religious) monuments
- Ship/airplane (car) registers
- ...

## Aspects not yet covered

- Processes: how to maintain consistency between two related distributed systems in case of updates: the cadastral production process depends on availability and quality of data at remote servers (e.g. Persons in population database)
- Catalogues with 'types of right' (per country?)
- Further modelling of cadastral survey
- Inclusion of a range of spatial units
- Generation of a full XML/GML schema
- Test with real data, in EULIS context
- Harmonise with other domain models, e.g. Topography, Water, Utility Networks

## Conclusion

- Current proposal is under development, workshops, reviews, etc
- More attention to process side (in addition to data side)
- Not only the model itself is important, but the fact that there is consensus (also important role of industry)

## Thank you