

## SUB WORKING GROUP SESSION THEMES

The **specific goals** for the workshop are to bring together the different communities, publish the results and standardize the cadastral domain model, with emphasis on: 1. legal aspects, 2. formalization, 3. testing in countries, and 4. industry involvement. The workshop uses two types of sessions to obtain the results: 1. presentations and discussion sessions (the normal type of session at workshop, symposium or conference) and sub working group sessions (SWG). During the SWG sessions smaller groups are working on a specific topic and try to make a list of relevant questions (the 'research agenda'), and next try to answer a number of these questions (or try to describe approaches to answer the questions, in case of larger open research problems). Every SWG has a chairperson, trying to organize and structure the SWG sessions (two parallel sessions on each topic). At the plenary closing session, the SWG chairpersons will present the main results related to their SWG theme.

### 1. LEGAL ASPCTS

*Chairperson: Yerach Doytsher*

The current FIG core cadastral domain model puts a lot of attention to the geometric side of the model. To get the model back in the right balance also the legal/administrative side of the model should be further developed. This covers aspects such as: rights of persons to lands, customary and so-called 'informal rights', 3D aspects, legal and survey based source documents. Some of the open questions for the sub-working group are:

1. Is there one general legal model (which can be used in every country, of course with applying specialization and adding some specific local classes/attributes/associations) or are the two or more fundamentally different general legal models?
2. Has the electronic of digital conveying of property ownership documents (both complete parcels or parts of parcels to be transferred) any effect on the model?
3. Should the focus be on the static side of the legal model (UML class diagrams) or should it also include the dynamic side of the model (e.g. UML activity diagrams)?
4. If complete groups of rights (or restrictions) have the same model structure (that is, the same attributes, associations, and constraints), but within a group clearly reflect a range of different rights, should there be an attempt to make an enumeration of the right types (one overall list or per country)? How is any meaning/semantics attached to a certain right type in this enumeration (text document with description)?

5. Very often a RightOrRestriction is both positive ('Right' side) and negative ('Restriction' side), do both sides have to be mentioned explicitly in the model (with the danger of inconsistencies) or is one side (positive 'Right' side) sufficient (and the other side can be derived from the model structure)?
6. Same type of question for a 3D cadastre situation: assume the basis is a 2D surface partition with parcels (representing infinite 3D columns) and bounded 3D parcels are then created as individual objects, should this space then also explicitly be removed from the infinite 3D column (or implicitly)?
7. What is the effect of having several legal actors involved in the process (surveyor, owner, buyer, the public, financial bodies, notary, municipality, land registry, cadastre), all allowed to perform certain steps (that affect the content/status of the model) in a kind of distributed systems (service/web-based) architecture? Should the model reflect this by indicating which actor is allowed to update which class (or attribute thereof)?
8. The common cadastral ownership model is "from the center of earth up to heaven". What about other models? What are the pros and cons regarding the different models? In view of developing nowadays the 3D cadastre in many countries, what are the legal limitations caused by the common cadastral ownership model "from the center of earth up to heaven" and how can it be solved?
9. In many countries there is a separation between the cadastral mapping and the legal ownership rights – in terms of two different agencies or governmental departments: a cadastral mapping unit handling the cadastral surveying and preparing the cadastral maps; and the registry unit handling the registration of cadastral ownership). Few countries are trying to define a different model and merge them into a unified department/agency being responsible both for the aspects of cadastre as well as the ownership rights. What are the pros and cons of these two models? Is it realistic to develop standard recommendations on the matter? Can they be adopted by different countries and societies?

## 2. FORMALIZATION

*Chairperson: Christoph Schlieder*

The current FIG core cadastral model is described in UML class diagrams (static model only). This implies certain formal semantics, but it has also its limitations. Specific formal ontology languages have been developed, which try to catch more semantics in machine-readable manner. Some of the open questions for the sub-working group are:

1. The first step of refinement of the UML class diagrams could be adding formal constraints to the model in the form of OMG's Object Constrain Language (OCL). Would this be applicable to the cadastral model (evaluate, show a number of OCL examples added to the model)?
2. How can this OCL-refined model be used in knowledge engineering based tools (e.g. to compare two different models and identify their differences and correspondences)?
3. What would more specific ontology languages (such as W3C's Ontlogy Web Language, OWL or OMG's Ontlogy Definition Metamodel ODM) add to the current core cadastral model?
4. What type of machine reasoning could benefit from having a more formal description of the model?
5. The current core cadastral domain model is limited to the static aspects; a lot of knowledge is also attached to the dynamic side of the model (the processes). What formal tools should be applied to the dynamic side of the model (and how is this related to the formal description of the static side)?
6. Would a more formal model (and the use of knowledge engineering tools) help in making the cadastral registrations in the different countries of Europe be more transparent, e.g. would it be possible to have 'one interface' fro information retrieval? The same for data (instances within the model) maintenance (both legal and geometric side)?
7. Assume that beside the core cadastral model, a number of models in related domains have been developed and formalized (e.g. topography, addresses, person registration, organization/business registration, subsurface mining registration, spatial development/planning, cultural history or monument registration, etc), what should (and can) we then do with knowledge engineering tools)?
8. Is it possible to check the related (other) domain models on overlap, (in) consistencies, and completeness? Should we try to harmonize these models (and perhaps adjust some of the individual models in order to make them fit)? Where and when does this harmonization stop as there may always be more remote (slightly related) domain models to consider?
9. Could knowledge engineering help in a distributed web environment (during the use and maintenance of the data within a formal model). E.g. certain constrains may be known at the source of the data, but what happens when a remote actor is updating a part of the model (in his local environment) and unaware of all constraints (at the source)?

### 3. TESTING IN COUNTRIES

*Chairperson: Robert Dixon-Gough*

The development of the current FIG core cadastral model has been based on the experiences of several persons in different countries and, in addition, several rounds of remarks (from different) countries in the world have been processed. However, this is an on-going activity and there is a difference in making remarks on the basis of a model described in a document or really trying to apply the model in a (prototype) implementation in a real world situation. Some of the open questions for the sub working group are:

1. When applying the model in a certain country (or developing a specialized model for a country), how much effort should be put into making this country model as similar as possible to the core model? For certain situations, two solutions might be possible. Firstly, with a 'little adjustment' the core model could fit. Alternatively, an alternative model could be proposed, which intuitively and more effectively fits the current thinking within this specific country, but possibly detracts from the emphasis of the core cadastral model. Which is the preferred approach?
2. In all probability, certain classes (attributes, associations, methods, constraints) will not be used in all countries. At what point should the decision be made that those classes be removed from the core model (since the core model should not be unnecessarily complicated).
3. Conversely, it will also turn out that certain classes (attributes, associations, methods, constraints) are missing and that this may be true for several countries. At what point should the decision be made that that these extensions do belong to the core cadastral model?
4. How should the maintenance of an (international) core cadastral model be organized (by ISO, FIG, OGC ...)?
5. Besides COST G9 meetings and FIG Comm. 7 meetings, should there be a structured set of meetings where experiences with applying the core cadastral model (and related tools from industry) can be exchanged?
6. Should the model be structured in different modules (as is now already the case). Furthermore, are the current modules practical or should these be defined differently?

7. In order to become the reference standard in as many cadastral situations as possible, and not be too large and complicated, the modular approach could also be interpreted in the following manner: there is a set of obligatory modules (without which it could not be a true cadastral model) but, in addition, there may be some extensions which are not needed in all countries which, should they be required, are similar. These could be the optional modules, ensuring that a certain kind of information/functionality is available. Can we define and describe these modules?
8. Is there a need to formalize the dynamic elements of the model? What are the expectations of this and are they feasible?

#### **4. GEO-ICT INDUSTRY**

*Chairperson: Oscar Custers*

Having a very nice model and even very well defined in a formal manner is one thing, but if this model is not used (applied), it is close to having no value at all!. Crucial in making it possible to apply the model is having tools available supporting this model in the environments of the users. For this purpose the role of the standardization institutes and industry is very important. For the industry it is also nice to have a situation that a cadastral solution (set of tools operation on the model) is not (too) specific for a certain country, because that would be an expensive development (for one customer). Having a shared model and implementations helps to lower the cost per actual implementation. Of course there will be different industry players competing, but when they base the solutions on the same model, it is better possible to meaningfully interface these tools from different vendors (e.g. during information exchange between different countries, or within different countries using tools from different vendors). Some of the open questions for the sub-working group are:

1. How can the relationship with OGC be seen within a Cadastral Environment (LandXML, LandGML, activities, domain models in other application area's)?
2. Supporting OGC standards for exchange of data is a different kind of level compared to the support of Models. What is the industry's view on supporting one generic Cadastral Model? If the industry player supports a certain Cadastral model, what rational is behind for the choice of this specific model? How does the core cadastral model fit in the product line of the relevant industry players, somehow the FIG core cadastral model assumes a 'model driven approach' (OMG's MDA). Are the tools from industry ready for this?

3. What is the need of an actual (interoperable) testbed environment; e.g. in the European context of EULIS (and INSPIRE in general)? Would one Cadastral Model be sufficient to service all Cadastres worldwide and how specific can such a model be? E.g. one country could be focusing on building up all information in a more 'basic' 2D environment where for other countries, Information Management and Publishing up to Cadastral Portals is of highest importance. To what extent should the Model be specified according to the industry as different strategies are taken by the specific companies? E.g. ESRI offers solutions around an SDE environment, Bentley around the Managed environment and InterGraph with a focus on InterOperability and Land Information Management. Is the industry growing into solutions with great similarity? If so, (we should avoid a Sales Story/Functionality comparison in detail) it is important to discuss to what extent the model is to be defined or can be defined (and how these can fit within the future plans, 1, 3, etc. years).
4. Industry implementations of the model, what is the current status and what are the future plans of these in 1, 3, 5, or 10 years timeframe?
5. What would the Maintenance implications be of the model in case of changes to n the core model (role of OGC, FIG, ISO, ...)?
6. What are the relationships to other related/overlapping domain models and how to keep the different related domain models consistent (harmonized)?
7. What is the vision of the companies versus to other related and (potentially) overlapping models? How important is it to be compliant with these models? Are the current or past implementations accordingly to these models?
8. How would a Cadastral Model integrate with Municipalities, internal and external Operational Systems e.g. tax operation/legal ownership, etc.