Land Administration Standards and Their Implementation in Practice

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Key words: Land Administration, Cadastre, Standards, GIS, Land Management

SUMMARY

In Land Administration there are many implementations and utilizations of standards from country to country. These applications are implemented by the acceptance of national standards (e.g. INTERLIS — Switzerland, MSZ 7772-1 — Hungary), and industrial standards or quasi—standards and specifications (e.g. AutoDesk DXF, ESRI Shape, GML, XML, WFS, WCS, WMS). The development of the first, international level land administration standard is going on in these days, which is based on the principles of the unified land registry, and generally models the operation of land administration.

Unified Land Registry has been operating in Hungary since 1972, wherein the legal and technical (cadastral mapping) of land registry unitize including organizational structure too. Standardization in Land Administration has been started in the middle of 90's based on the modern information technology fundamentals. This paper deals with the steps of standardization and physical implementation of principles and requirements included in standards. Operating of the unified, integrated information system provides a modern, integrated data service and authentic data management in Land Registry. Beside the above the paper shows the conformance of the Hungarian Model with the structure and logic of ISO LADM as an operational, physical implementation of the international standard.

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1. INTRODUCTION

Unified Hungarian Land Registry has been operating since 1972. The Hungarian Land Registry is a title registry, so the Hungarian State guarantees the rights and facts included in the registry. The 36 years of experiences provides a good professional background for different developments and solutions in Land Management Sector.

In the mid of the 90's within the frame of Computerization Program of Land Offices the Hungarian Land Management Sector has developed the base information system for the Unified Land Registry, called TAKAROS. TAKAROS covers all the business procedure in the legal part of the Unified Land Registry (e.g. application registration, management of land records, data service, billing, posting etc.), but it does not manage the geometric part (cadastral maps).

In 1996 the Hungarian Standards Institution accepted a standard (MSZ 7772-1, Digital Base Map, Conceptual Model), which defined a solution for cadastral database, but only for the geometric (cadastral map) part of the Unified Land Registry.

From 1997 till 2008 in the frame of different cadastral projects of National Cadastral Program Non-profit Company 900 000 hectares (approx. 10% of the whole territory of Hungary) was covered by these standardized database.

In 2003 a new development started at the Institute of Geodesy, Cartography and Remote Sensing (FÖMI), to integrate the standardized cadastral and legal part of the Unified Land Registry, called DATR (Digital Base Map Manager). At first stage the graphic engine of the software has been used for Cadastral Map Services on Internet (TAKARNET). But now, the integrated information system of the Unified Land Registry will be introduced by the mid of 2009 in Hungary.

The integrated information system's data model has many similarities with ISO Land Administration Domain Model (LADM) standard proposal. It stands to reason, as LADM also describes a Unified Land Registry.

This paper deals with the integrated information system of the Unified Land Registry of Hungary, shows the similarity between the Hungarian model and ISO LADM proposal.

2. MODEL OF THE HUNGARIAN UNIFIED LAND REGISTRY

The base principle of the Hungarian Unified Land Registry is that, the management of rights, restrictions and facts registered in land registry and the handling of geometric representation of them (cadastral maps) are integrated and commonly realized in 120 land offices.

TAKAROS system covers all functionalities of the legal part of Unified Land Registry. It is an important fact, that the continuous development (patching) and customization of TAKAROS based on user requirements are the responsibility of FÖMI. All source codes of the system are available within FÖMI.
In order to really integrate the two parts (legal and geometric) of the Unified Land Registry FÖMI has defined the following principles and visions of the new system DATR: [3, 14, 15]

- DATR must map all the principles of Unified Land Registry,
- DATR must be compatible with the requirements defined in Digital Base Map Standard and Instructions,
- DATR must provide the authentic updating both the legal and geometric part of the unified registry,
- DATR must be independent of any commercial GIS system,
- DATR must cover all business procedures related to cadastral maps at the district land offices,
- DATR's solutions must fit in with the existing information systems (TAKAROS).

Based on these principles and visions the development team of FÖMI has decided that the architecture and characteristics of the system should satisfy the next requirements:

- Total integration with TAKAROS system
  - In database structure,
  - In ability system,
  - In transactions,
  - In data service,
  - In system administration,
- Uniform database structure:
  - One scheme,
  - Administration of changes,
  - Enforcing of database integrity,
- Tracking of temporal changes:
  - Archiving,
  - Displaying any arbitrary status of cadastral map,
  - Updating in background procedure,
- Real-time queries via TAKARNET network:
  - Integrated search with the real property registry,
  - Real-time map generating,
  - Minimizing network weighting,
- Modular, self-calibrating architecture
  - All the functions are in modules,
  - Explicit and implicit communication among modules,
  - No client side configuration is needed to insert any new module,
- Easy extendable
  - Uniform calling interface and protocol
  - Usable base modules,
  - Opened module API
- Operation system and RDBMS

- Windows NT 4.0 or Windows 2000 server and client,
- ORACLE v8.05 RDBMS or higher (because it is operating at the Land Offices, but the functions are compatible with the higher version ORACLE RDBMS too.)

2.1 Data model of DATR

The core data model of DATR is very similar to the Land Administration Domain Model defined by our Dutch colleagues. ([4], [13]) The data model is adequate to execute, supply and monitor all the functions, constrains and procedures operated in the Hungarian Unified Real Estate Registry. The core data model of DATR is shown on Figure 1. [16, 17]

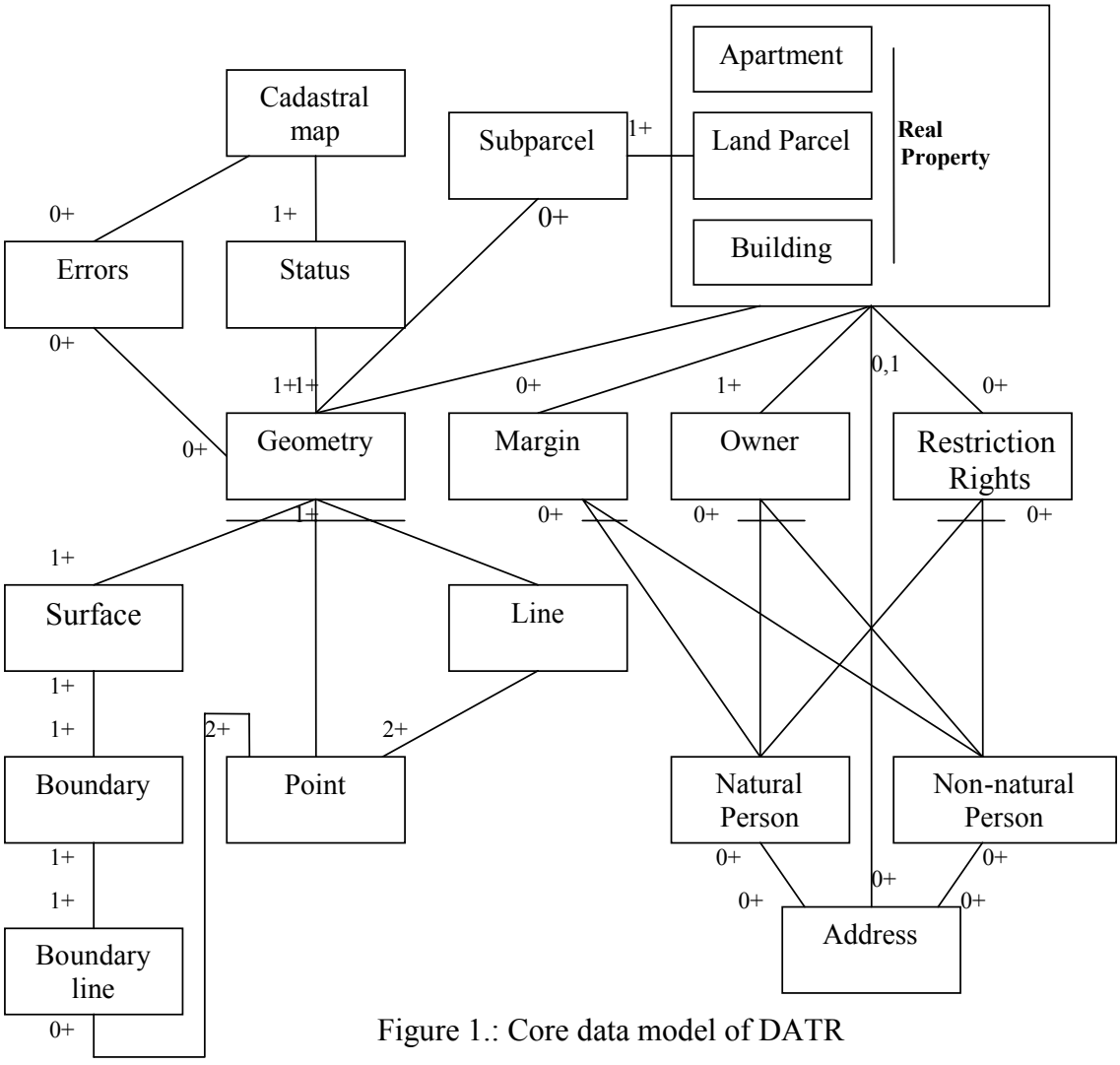

Figure 1.: Core data model of DATR

As shown on Figure 1., there could be three types of real property: apartment, building and land parcel, but a real property must be one of them. In Hungarian land registry the apartments have no geometric representation, but the land parcels and buildings.

In the part of geometry an object can be point, line or surface type object. Therefore if a cadastral map object has no connection to the land registry (e.g. railroad), there is no relation between the land and the geometric tables (0+ indicates, that there are zero or more relations to the tables). Structuring of geometric tables is unambiguous.
Object called Margin has a very special role in the land registry. Margin provides the ordering principle of land registry. If the Land Office receives any application related to the real property, the Land Office must register it and Margin shows the flag of the application on real property. Of course there could be zero or more margins on the real property (0+). The margin also register the person who made the application, therefore there is a link to the natural or non-natural person.
The role of the owner is unambiguous. One real property must have at least one owner (1+), which could be a natural or non-natural person.
The real property can have an address or not (0+).
There could be rights (e.g. easement, mortgage) and restrictions related to the real property. The Restriction object makes for this purpose. The Restriction can be connected to a person, too.
Each person (natural or non-natural) — who has any connection to the Land Office — is registered in the database with his address, too.
This core data model has been physically achieved in DATR system and is able to manage the cadastral map data and real property registry in an integrated way.

2.2. Real property transactions in DATR

Real property transaction is one of the most important procedure in the Land Office's activity. Its legal and surveying relations must be handled very rigorously in an integrated cadastral system. The real property transaction in DATR contain the following steps (see Figure 2.):

- Application registration in order to map data service,
- Allocation of affected real properties,
- Generating of changing area,
- Data service for changing (both map and land registry),
- Closing the legal procedure (end of data service for changing),
- *Changing data in an other system (e.g. ARC/INFO),*
- Application registration for uploading map changing
- Uploading changed map data to the work map,
- Automatic and manual checking of changed data,
- Adding a reservation for map change in cadastral part,
- Closing the legal procedure (end of changed data uploading),
- Application registration for changing land registry,
- Transactions in land registry part,
- Adjudication and updating (legally valid map and real property),
- Closing the legal procedure.

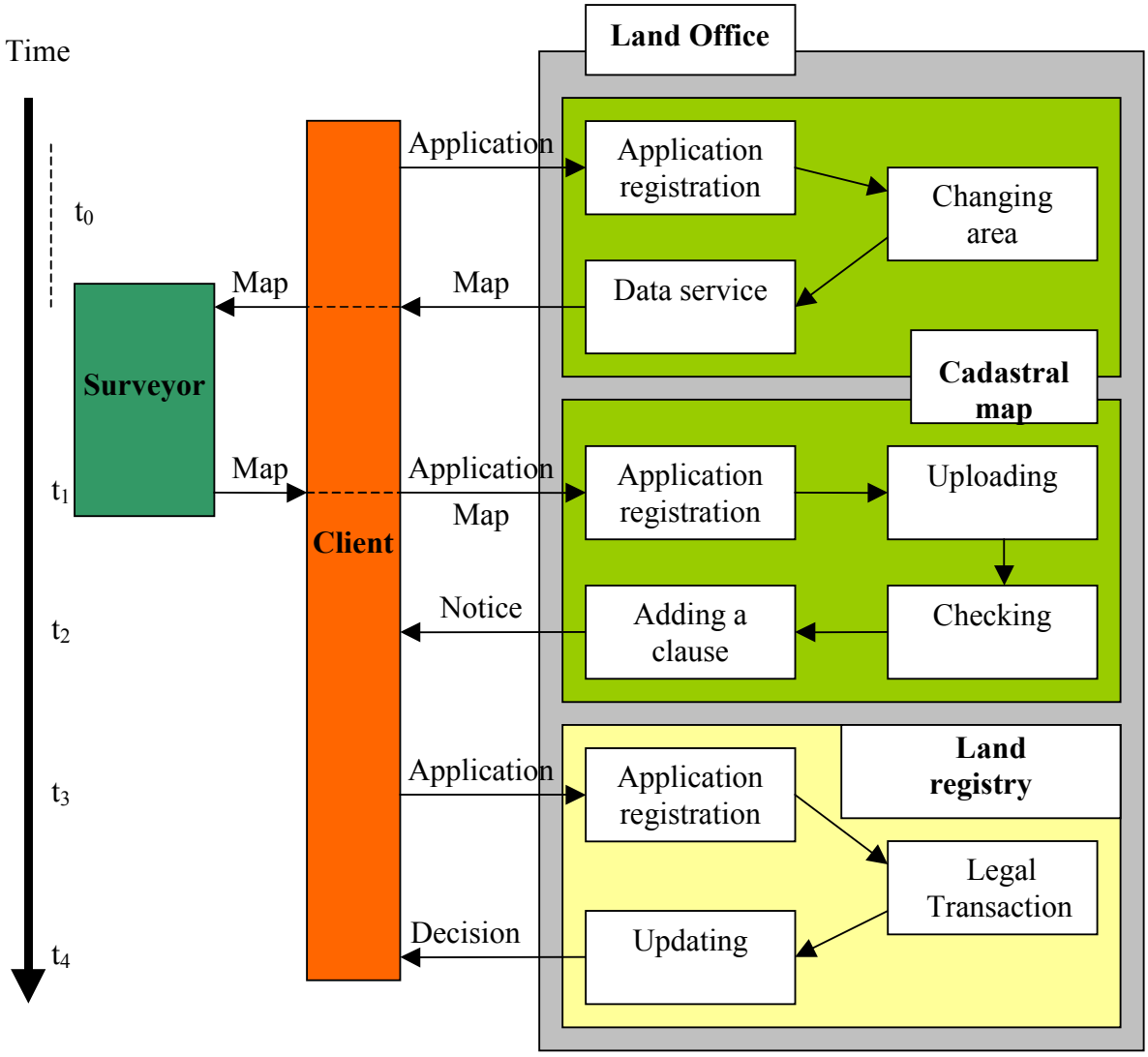

Figure 2.: Real property transaction in DATR

Application registration in order to map data service
This procedure is carrying out by the application registration module of TAKAROS system

Allocation of affected real properties
Allocation can be executed by three ways:

- Listing of lot numbers of parcels,
- Selection of real properties and other objects on the map,
- From the selection of the land registry.

Generating of changing area
DATR generating changing area with the boundary of the area, land parcels and objects belongs to the land parcels and other objects within the changing area.

Data service for changing (map and real property)
The client receives the map and real property registry data. Data service is available in different forms (e.g. ESRI SHAPE, DXF etc.).

Closing the legal procedure (end of data service for changing),

Changing data in an other system (e.g. ARC/INFO),

Application registration for uploading map changing
It is the same as in the case of data service

Uploading changed map data to the work map
Work map is a distinct area of the database.

Automatic and manual checking of changed data
Checking contains the following tasks:

- Formal and syntactical checking based on Cadastral Standard,
- Checking of inner consistency (e.g. links),
- Checking of geometrical consistency (e.g. topology),
- Temporal consistency checking (e.g. coincidence to the map data service),
- Checking of integrity (e.g. integrity with land registry).

Adding a clause
During the addition of a clause the following procedures are executed:

- Objects of the changing area will be erased (only logically),
- The objects of the working map will be uploaded to the legally valid map (flagged with clause),
- The new real properties will be uploaded to the land registry (flagged as preliminary),

Closing legal procedure (end of changed data uploading)

Application registration for changing real property registry
It is the same as in the case of data service

Transactions in real property registry
Legal checks are performed

Decision and updating (legally valid map and real property)
This task finalizes the changes consistently both in cadastral and land registry database. In the case of the cadastral map it means:

- The erased objects will be deleted physically from the valid map,
- The clause-flagged objects will become legally valid.

Closing the legal procedure
It is important, that the client has a one year period applying land registry changes after the clause on map change. If the client does not apply land registry changes within this period, the map change (and the clause) will be cancelled [14].

2.3. Architecture of DATR

The architecture of DATR is shown on Figure 3.

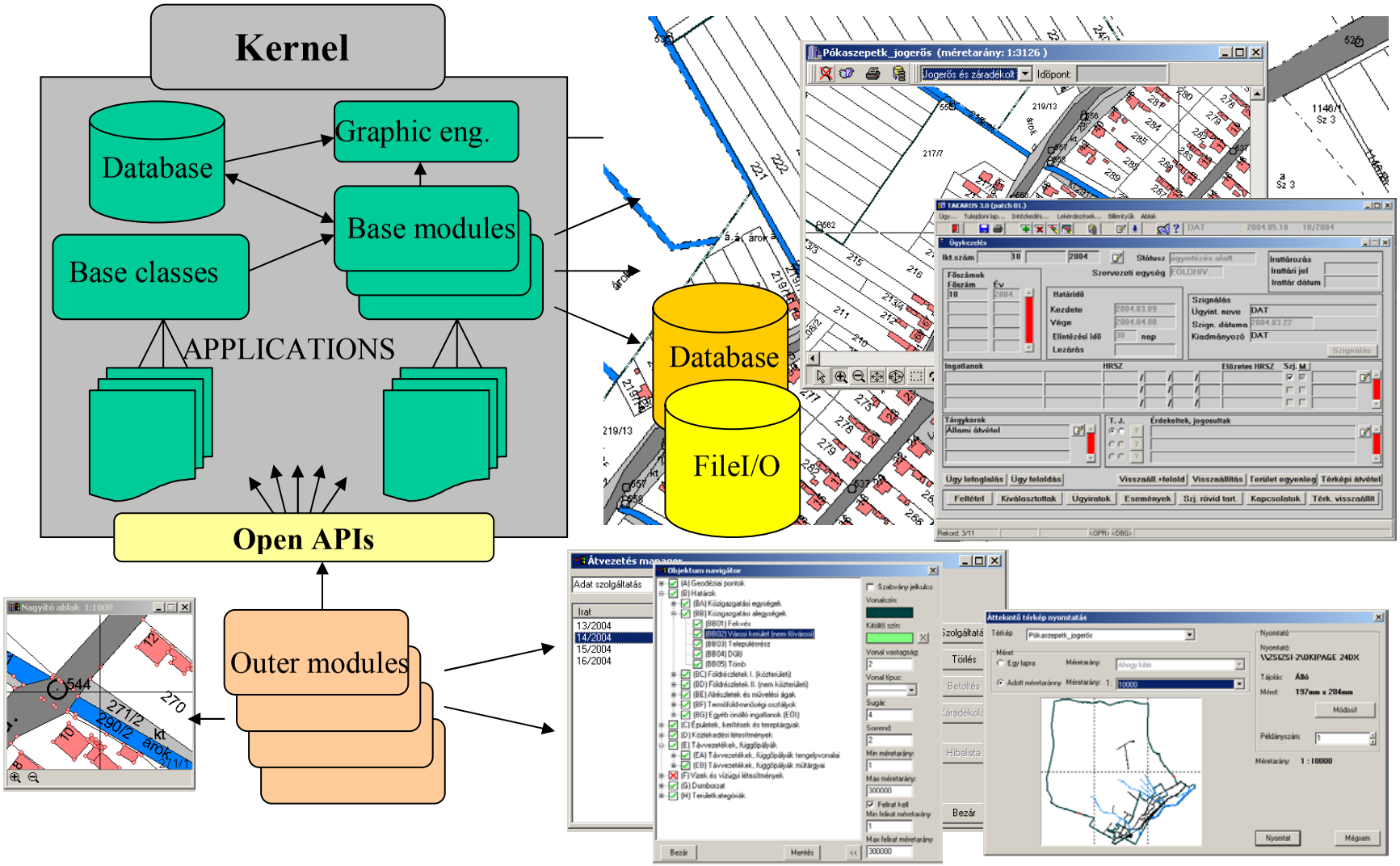

Figure 3.: Architecture of DATR

As shown on Figure 3. DATR has a kernel, which contains the database itself, the base modules, the base classes and the graphic engine, the last being responsible for the graphic representation of map objects stored in the database. The source code of this part of the system is hidden from users, however with the help of open APIs they are able to code different applications for the system using the base classes and modules. Applications are the manifestation of modules for the users, which means user is able to handle module functionalities via applications. The outer modules are communicating with the kernel via open APIs. The base modules are responsible for external database connections and file input-output [3].

3. SIMILARITIES WITH ISO LADM

ISO LADM proposal core model based on three classes:[19]

- Spatial Unit,
- RRR (Rights, Restrictions and Responsibilities),
- Party (including Groups).

Taking a look at Figure 1. (Core Data Model of DATR) ISO Spatial Unit is defined by Geometry (Surface). It is not included in Figure 1., but beside Geometry, topological relations are also defined in Hungarian model, which satisfies ISO Spatial Unit representation: solids, faces, edges and nodes.

Rights and Restrictions are explicitly defined in Figure 1, but responsibilities are also stored with relationships to the Persons in the legal part of the system (TAKAROS, TAKAROS model is not included in Figure 1.).

Parties are explicitly defined in Hungarian model as Natural or Non-Natural Person (Figure 1.). In Hungarian model there is no direct relationship between Party and Spatial Unit, but only via RRR, which totally the same solution as in ISO LADM. [19]

ISO LADM allows to maintain the data in different organizations, but fortunately in Hungary this maintenance is the responsibility of the same organization, the Land Office Network.

Definition of Spatial Unit, RRR and Party is the similar in the Hungarian model as in LADM. Spatial Units in the Hungarian model can be stored in 3D space, but at this stage of the system only 2D capacity of the system is used.

In the Hungarian system TopologicalSpatialUnit and BuldingUnit (Apartment see Figure 1.) are used similar to ISO LADM.

SpatialUnitSet is also used in Hungarian Unified Land registry, based on the original surveying method of the parcels, and the topography of the ground. In Hungarian model three types of SpatialUnitSet are available: rural, built-up and garden areas.

From Surveying Package of LADM only SurveyPoint is used in the Hungarian model. Introducing of SurveyDocument into the model is planned, but is not elaborated yet.

Geometry and Topological Package in Hungarian model is nearly the same as in LADM.

Party package in Hungary is modeled in the same was as in LADM.

Administrative package is modeled in the similar way as in LADM in Hungary. Administrative objects are modeled in the legal part of the Hungarian system by a very similar way as in LADM, but only documentation is not modeled yet. Hungarian Land Administration is planning to introduce digital documentation in the model.

4. DATR, THE INTERNATIONAL VERSION

The geometric part (cadastral maps) of the Unified Hungarian Land Registry is managed by a software solution (DATR) developed by FÖMI. The DATR system can be managed flexibly, therefore FÖMI has decided to develop an international version of the system. [18]

In the international version of DATR all modules and applications (including kernel) have a lingual description in XML format, which describes the lingual functionality of the module. Therefore each module can be customized into any languages including the graphic user interfaces.

With open API interface each module can be modified to any certain legal and technical environment.

The international version has two interfaces, one to ORACLE and the other to MySQL RDBMS. If client needs then interface can be developed to any other SQL based RDBMS.

The above-mentioned architecture and flexibility empowers DATR (with some customization) to use in any Land Administration system as a cadastral map management system. FÖMI as the part of Hungarian Land Administration is able to maintain this system in any environment both technically and professionally level, including professional guidance.

5. CONCLUSIONS

In this paper the authors wished to show the developments of FÖMI in Land Administration Domain. The Hungarian Unified Land Registry is a good example for the integrated land registry and cadastral map management. Cadastral map management system, DATR is an object—oriented approach and a flexible solution for the authentic unified land registry management. To introduce the Land Administration community to this system, FÖMI is ready to publish DATR, as a freeware software. FÖMI's capacity both in IT and land administration professionals guarantees the long-term maintenance and support of the system. Customization of the international version of DATR is very easy via linguistic descriptions. With the help of open APIs interface anyone can customize the system into his legal and technical

environment. Naturally FÖMI is ready to undertake the task of customization and/or professional guidance for the users of DATR, as well.
Similarities with ISO LADM standard proposal showed that the Hungarian Land Administration Sector decided to follow the right way in the development of a Land Administration 37 years ago. This experience provides a real, strong background to satisfy the requirements of the future challenges in land administration.

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BIOGRAPHICAL NOTES

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Zoltán WENINGER (52): has a degree in mechanical engineering (faculty of system organizing). He is currently the head of Centre for Land and Geoinformation Developments

and Operation at FÖMI. He has participated in the establishment of computer based land registry from the beginning. He is the leader of DATR project.

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