

Object Oriented Unified Real Estate Registry for a Good Spatial Data Management

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Key words: Cadastre, Land Administration, GIS

SUMMARY

The IT developments of the last ten years in Hungarian Land Administration (standardization, information systems) built up a frame, which was able to define new concepts for the further developments in the Unified Real Estate Registry of Hungary.

The unified real estate registry in Hungary means that the real estate management of both the geometric part (cadastral maps) and the alpha-numeric part (land records, ownership, mortgages, other relevant facts and rights belonging to the real estate) are handled by one administration called Land Office Network of Hungary. This organizational background provided a stable base for the elaboration of an integrated information system of Land Offices.

Within the frame of the National Cadastral Program of Hungary many object oriented map databases and vector format maps have been come into existence. The large amount of map data, harmonized with the Unified Real Property Registry data, provided to start Integrated Land Information Services on network.

The paper deals with the background of projects, the developments and the new services based on the object oriented Unified Real Property Registry of Hungary.

1. Introduction

During the last ten years there have been many developments in the Hungarian cadastral domain. The basis for them were national legal, technical and constitutional circumstances, namely the Act on Surveying and Mapping Activities [1], the Act on Real Property Registry [2] as well as the national standard “MSZ 7772-1:1997 Digital Base map. Conceptual Model” issued by the Hungarian Standards Institution (referred to as DAT-standard) [3].

The unified real estate registry in Hungary means that the real estate management of both the geometric part (cadastral maps) and the alpha-numeric part (land records, ownership, mortgages, other relevant facts and rights belonging to the real estate) are handled by one administration called Land Office Network of Hungary. This practice was working for analogue data from 1972. During the developments in the 90's only the alpha-numerical part of the real-estate registry has become operational by IT tools. This system, called TAKAROS, is working at each District Land Office (120), except the IT system of

Budapest Land Office. Budapest Land Office has a different cadastral IT system, called INFOCAM/BIIR, which is a result of an independent development.

DAT-standard defines an object oriented database scheme based on the CEN TC287 GIS pre-standards by its structure and on the national legal and technical traditions by its content. The DAT-standard has been elaborated in the Institute of Geodesy, Cartography and Remote Sensing (FÖMI) by the leadership of Dr. Szabolcs MIHÁLY. After heavy and constructive nationwide consultation and harmonization with all the groups interested in cadastre ([8], [9], [10], [11], [12], [13], [14]), the standard has been accepted, making radical progress in view of the profession and the users on the matter of cadastre.

Based on this standard and the above mentioned Acts logical model of the cadastral system has been developed by FÖMI in form of the Hungarian Cadastral Base Map Instructions, referred to as DAT-instructions [4]. Among these instructions the logical database model [5] serves as information technological basis for constructing a nationwide object oriented unified real estate registry database in Hungary.

In the National Cadastral Program of Hungary 97 settlements have been surveyed accordingly the DAT standard and instructions (approx. 550 000 ha). The object oriented databases of these settlements are available now. Then — for speeding up — the National Cadastral Program has been continued with the vectorization of the analogue cadastral maps (KÜVET and BEVET project). The cadastral maps in Hungary can be divided into three categories by the location. The cadastral map categories are:

- Cadastral maps of the rural areas of settlements,
- Cadastral maps of the gardens within the rural areas of the settlements,
- Cadastral maps of the built-up areas of the settlements.

The KÜVET project covers vectorization of the first category (rural areas of the settlements). This project was finished at the end of 2005. In BEVET project the other two categories of the cadastral maps will be vectorized. The estimated finish of BEVET project is the end of 2007.

The last sections showed, that our unified real estate registry has all the possibilities (on organizational, technical and data availability level) to build up fully integrated IT system for land management.

In this paper the executed and planned executory steps for the integrated land management system will be shown.

2. DAT standard and instructions

The role of DAT standard and the respective Instructions are to determine the objects in the cadastral database, to define their geometric properties, connectional and qualitative characteristics and principles of the integration of them and their metadata ([3], [4], [5]).

The data model of DAT standard is in accordance with prEN 287001:1995, Geographic Information — Reference Model European prestandard. The standard's reference system

is the Hungarian Geodetic Datum (HD-72), projection system is EOVS (Uniform National Projection System) and the height datum is Kronstadt (Baltic system) [16].

The objects are classified into object-classes, object-groups and objects according to the hierarchical level. Classification of object classes and objects groups is the following:

- A** **GEODETIC POINTS**
 - AA** **Horizontal and 3D geodetic control points**
 - AB** **Vertical control points**
 - AC** **Vertices**
- B** **BOUNDARIES**
 - BA** **Administrative units**
 - BB** **Administrative subunits**
 - BC** **Land parcels (public)**
 - BD** **Land parcels (private)**
 - BE** **Subparcels and land use**
 - BF** **Soil-quality categories (for arable land)**
- C** **BUILDINGS, FENCES AND TERRAIN FEATURES**
 - CA** **Buildings, houses**
 - CB** **Building attachments**
 - CC** **Fences, abutments, and earthworks**
 - CD** **Terrain features**
 - CE** **Statues, memorials**
- D** **TRANSPORTATION**
 - DA** **Characteristic points of transportation**
 - DB** **Transportation in built-up areas**
 - DC** **Transportation in rural areas**
 - DD** **Railroads and other fixed-way transportation**
 - DE** **Airline infrastructure**
 - DF** **Transportation structures I.**
 - DG** **Transportation structures II.**
- E** **SPAN-WIRES, TELPHERS**
 - EA** **Axes of span-wires and telphers**
 - EB** **Structures of span-wires and telphers**
- F** **WATER AND WATER STRUCTURES**
 - FA** **Rivers and lakes**
 - FB** **Public utilities**
 - FC** **Water structures**
- G** **RELIEF**
 - GA** **Contour lines**
 - GB** **Features of relief**
 - GC** **Digital Elevation Model**
- H** **OTHER AREAS**
 - HA** **Surveying area**
 - HB** **DAT database handling unit**
 - HC** **Expanses**

Objects geometrically separated into three categories: point, line and polygon type objects. The geometry of an object stored in 2D, the third dimension (height) is stored in attributes. The thematic structure of DAT is shown on Figure 1.:

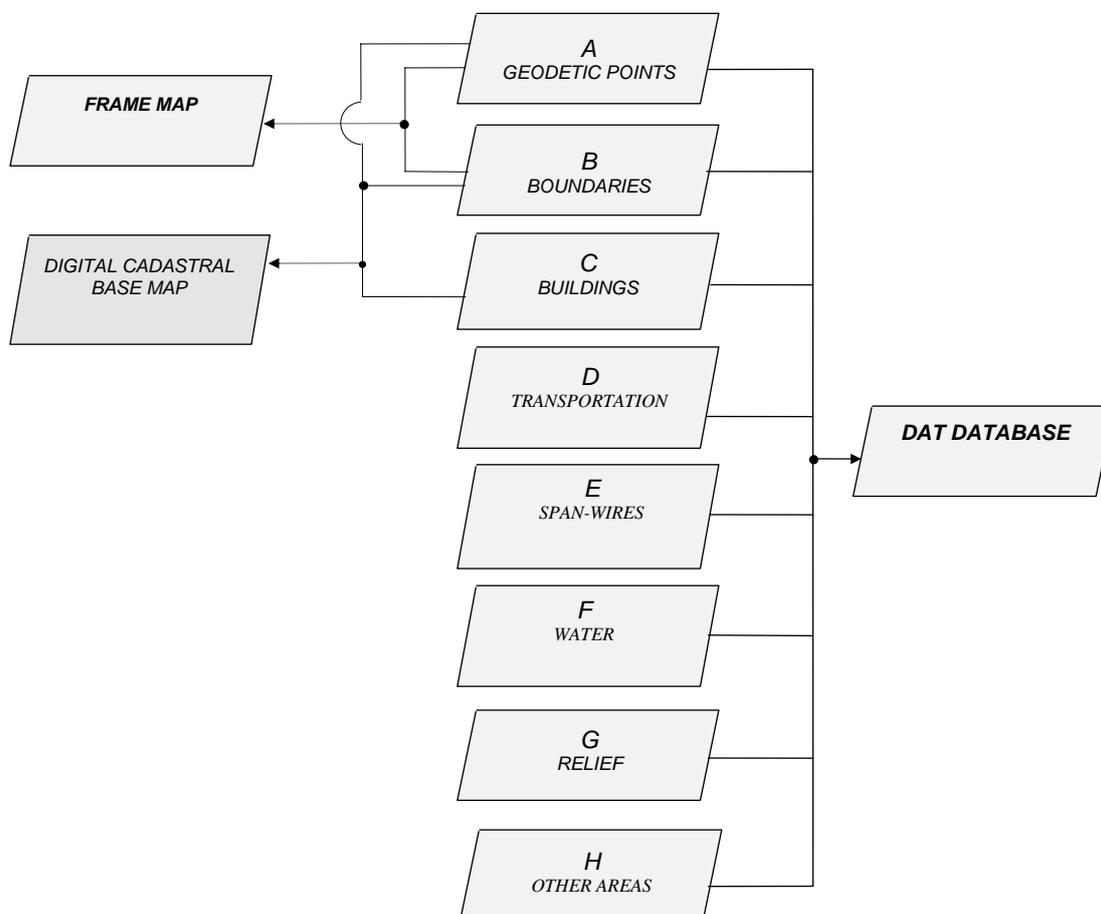


Figure 1.
Thematic structure of DAT standard

As shown on Figure 1. DAT standard contains much more objects than a cadastral map needs. During the elaboration of DAT standard there has been many harmonization discussions among the different sectors of the Hungarian economy. It is the reason why there are so many objects in the standard. But as Figure 1. shows, the cadastral base map contains only 3 object classes. These 3 objects classes are defined as State Base Data in the standard. In National Cadastral Program only the objects of these 3 classes are determined and organized into a cadastral database.

3. National Cadastral Program and its activities

In introduction the three main projects of National Cadastral Program has been mentioned. These activities are carrying out by the National Cadastral Program

Nonprofit-Company. In the first period of the program DAT databases has been established for 97 settlements of the country. These settlements cover 550 000 ha, which is approximately 5% of the whole territory of Hungary (Figure 2.)

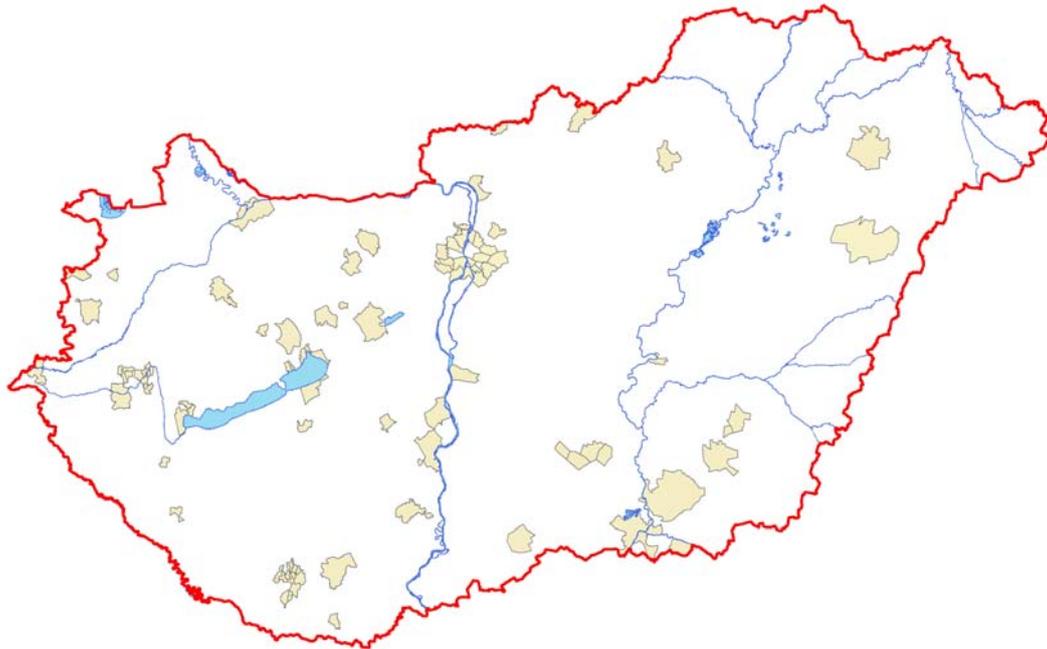


Figure 2.: Settlements with existing DAT database¹

KÜVET project was planned to convert cadastral maps into more usable vector format. But the program did not contain only the vectorization of maps, it also included the harmonization of the vectorized map data with the real property registry. This project was finished at the end of 2005. Since the beginning of 2006 the rural areas of the settlements are available in vector format. This vector format is a special format of a Hungarian software called ITR (Interactive Mapping System), but can be exported into different popular vector formats like AutoCAD DXF, ESRI Shape etc.

BEVET is the twin brother of KÜVET project. In BEVET the other two categories of the cadastral maps will be vectorized (gardens and built-up areas) and vector map data will be accorded with the real property registry. The output is the same like in KÜVET, ITR format vector data. The planned finishing of BEVET project is the end of 2007. So, from the beginning of 2008 all cadastral map data in Hungary will be available in vector or object oriented database format and all map data will be harmonized with real property registry.

¹ Source: <http://www.nkp-kht.hu>

During the execution of BEVET program, in the cases of old cadastral maps, new DAT databases will be created. This project covers about 400,000 ha. So we can declare, that 9% of the whole territory of Hungary will be available in object oriented database format till the end of 2007. Figure 3. shows the location of these settlements:

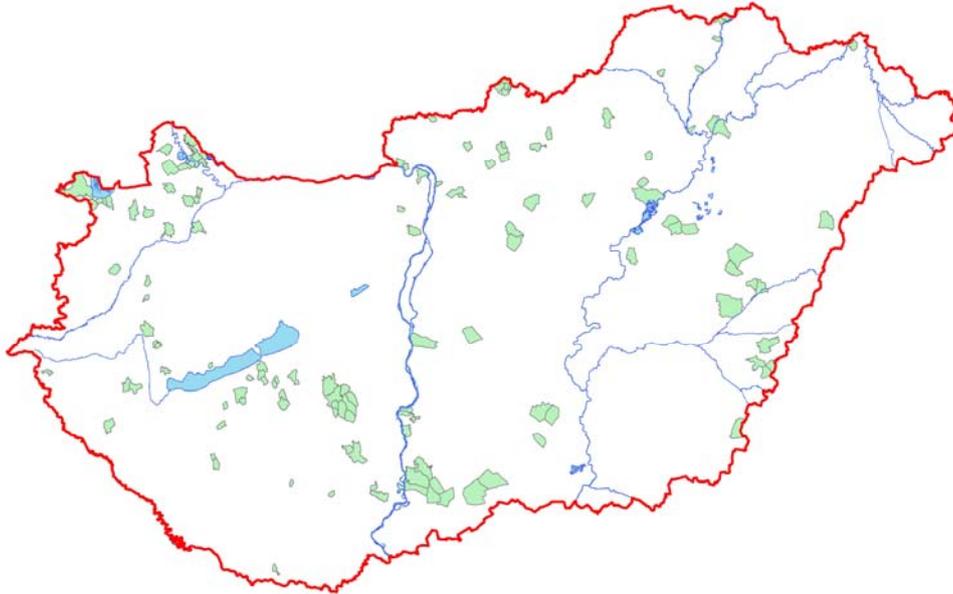


Figure 3.: Planned new DAT databases in BEVET project²

4. IT developments for the Object Oriented Unified Real Estate Registry

In the last sections we described the current situation in Hungarian Land Administration, which provides a good frame for different IT developments.

At first stage, we wanted to solve geometric (map) data handling based on the standardized environment. To fulfill this requirement in the developments our main visions were the following:

- In the unified real property registry cadastral maps are the geometric attributes of land records registered in real property registry,
- The system should provide authentic updating of real property registry and cadastral maps together,
- The developments should be independent of any commercial GIS software,
- The system should cover all the business procedure in Land Offices,
- The system should fit into the existing IT systems in Hungarian Land Management.

² Source: <http://www.nkp-kht.hu>

The result of the developments is a graphic map manager software (called DATR, DAT Based Mapping System), which main characteristics are the following:

- Total integration with the existing TAKAROS system
 - Database structure,
 - Ability system,
 - Transactions,
 - Data service,
 - System administration,
- Uniform database structure with TAKAROS system:
 - 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 need 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 (because it is operating at the Land Offices, but the functions are compatible with the higher version ORACLE RDBMS too.)

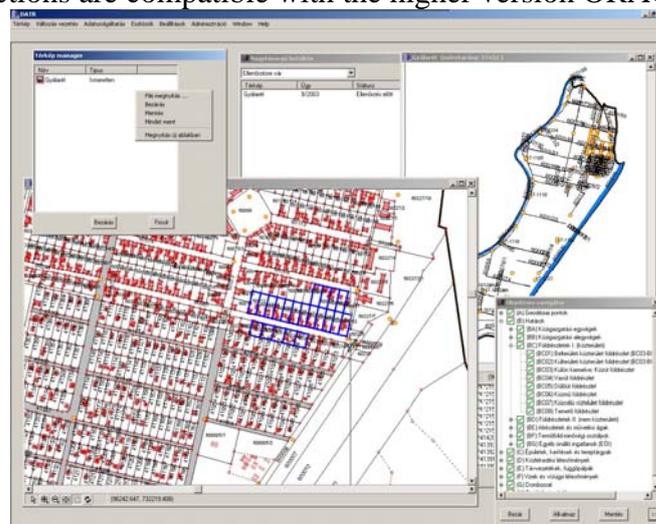


Figure 4.: Screenshot of DATR system

4.1 Core Data Model of DATR

The core data model of DATR is originated from the logical database model defined by DAT1-M1 Instruction ([5]). This model is very similar to the Cadastral Domain Model (Lemmen, Van der Molen, Van Oosterom, Ploeger, Quak, Stoter, Zevenbergen, 2003.[7]) defined by our Dutch colleagues. 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 5.

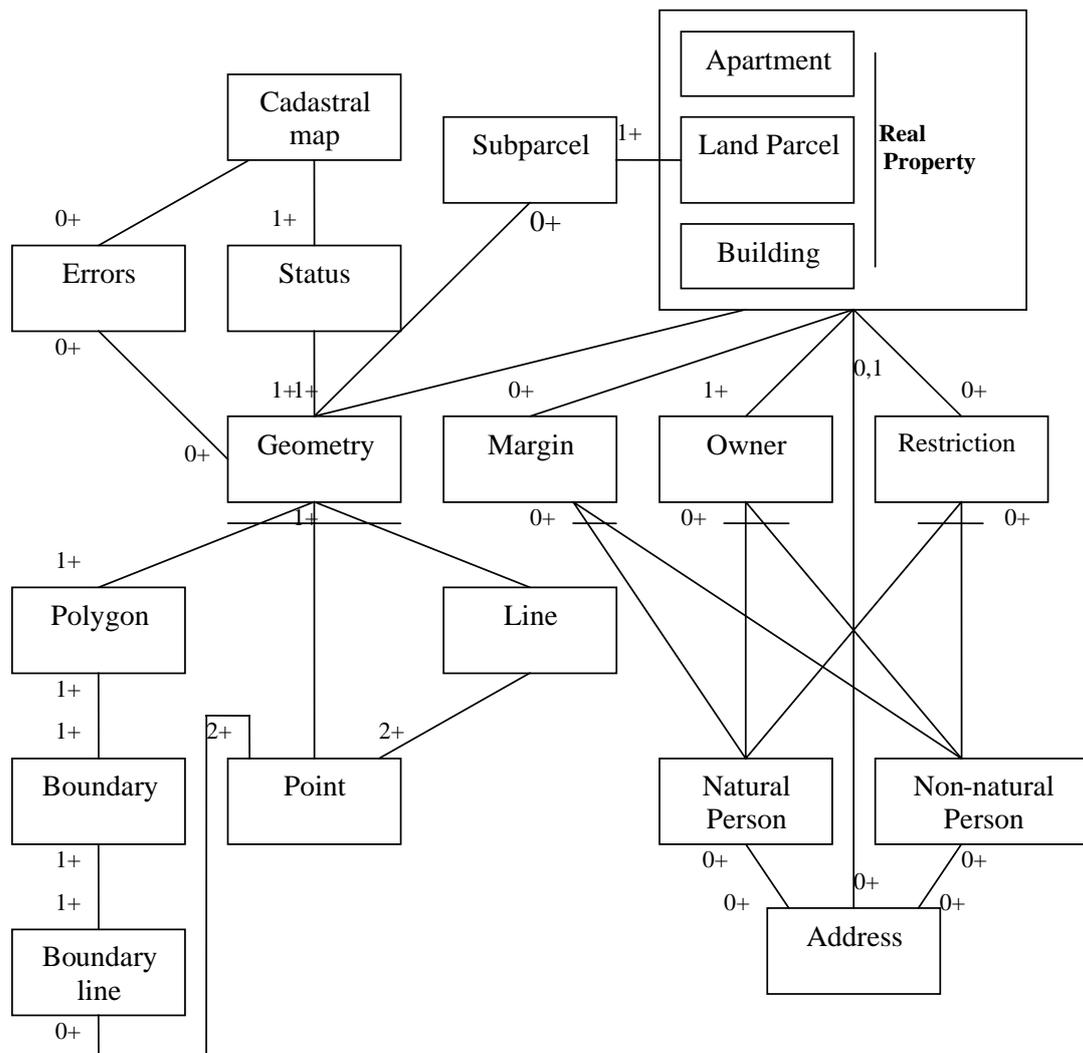


Figure 5.: Core Data Model of DATR

As shown on Figure 5., there can be three types of real property: apartment, building and land parcel, but a real property must be one of them. In our unified real property registry the apartments has no geometric representation, only the land parcels and buildings have.

In the part of geometry an object can be point, line or polygon type object. Therefore if a cadastral map object has no connection to the real property registry (e.g. railroad), there is

no relation between the real property 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 real property registry. Margin provides the ordering principle of real property 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 can be a natural or non-natural person.

The real property could has 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. The DATR system has already been working and based on the functionality of it, we have developed different land information services on network.

4.2 Land information services in Land Management

TAKARNET is the name of the nationwide intranet network of the Hungarian Land Administration. The nodes of the network are the County Land Offices, the District Land Offices, FÖMI and the Ministry of Agriculture and Rural Developments. FÖMI is responsible for the operation, maintenance and development of the network. Registered users (e.g. notaries, lawyers, banks) can be connected to the system via TAKARNET.

The land record services for registered users on TAKARNET has been started in 2003. The annual number of land record queries is approx. 1,4 million, which generates a real high income for the Land Management sector.

The cadastral map services, which are integrated in the land record services, has been started in 2005., on first stage for the Budapest Land Office. As it was mentioned in introduction section Budapest Land Office has a different IT system (INFOCAM/BIIR) than TAKAROS. The cadastral map services is operating on the following architecture (Figure 6.):

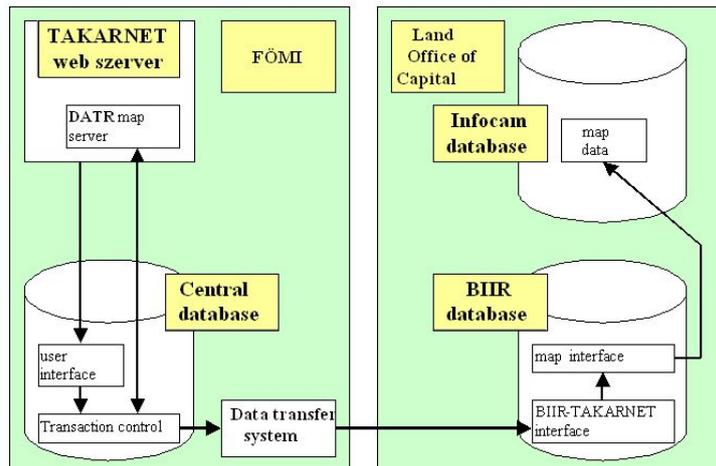


Figure 6.: Architecture of map services

As shown on Figure 6., the graphic engine of the cadastral map service is our own-developed DATR system. The map service is working in PDF format, which means our service is platform-independent.

Since KÜVET program (see section 3.) had been finished last year, there were a lot of vector format cadastral maps, which should have been integrated into TAKARNET services. This fact generated different problems in the development (e.g. KÜVET maps are in ITR vector format, not in relational database format). For the solution we have used the flexible functionality of DATR and in-cooperation with ITR developers (Digicart Ltd., Hungary) made an interface for the services (Figure 7.).

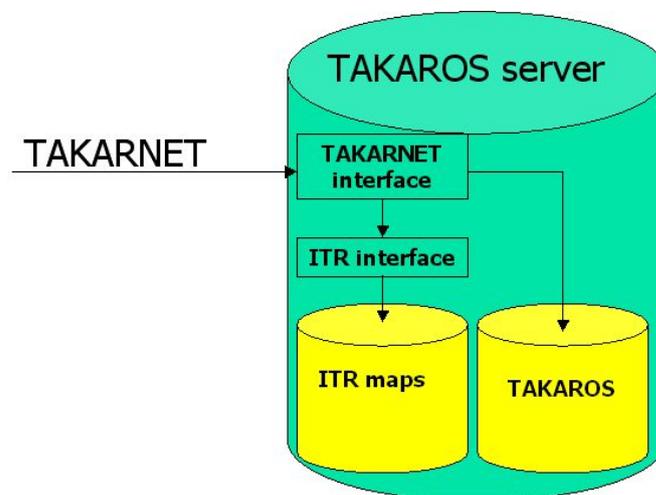


Figure 7.: Map services from KÜVET maps

From this month, KÜVET map services is operating in TAKARNET map services, fully integrated with the older ones.

5. Conclusions

In this paper we intended to represent the legal and operational framework of the Hungarian Land Management sector, focused on the IT solutions of the Unified Real Estate Registry.

Standardized mapping data greatly increase the effectiveness of developments and decrease the time needs of them. Experiences and knowledge base on Unified Real Property Registry also added geared up the implementing of the IT system.

Our solution DATR showed that it was possible to develop a cadastral IT system with own sources, without any depending on commercial product. DATR is a system, which flexible and effective enough to expand to the new IT challenges in Land Administration Sector. The system is opened, so we are able to extend for international connections too, which are probably required in the near future (e.g. INSPIRE directive).

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