

DEVELOPMENT AND IMPLEMENTATION OF NEW IT SYSTEM FOR REAL ESTATE CADASTRE OF THE REPUBLIC OF MACEDONIA

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ABSTRACT

This paper presents development and implementation of new IT system for Real Estate Cadastre of the Republic of Macedonia. The Agency for Real Estate Cadastre, Skopje (former State Authority for Geodetic Works, Republic of Macedonia) is an individual state body in charge of conducting the geodetic works and registering the real estate rights. According to the strategic business plan and Information and Communication Technology Strategy the Agency for Real Estate Cadastre started the project for new IT system for Real Estate Cadastre in 2007. The primary goal of this new system was to develop efficient system for registration of technical and legal (ownership, rights) information about real estates. The old Real Estate Registry system was very outdated, technologically very limited (based on file system) and it covered only the descriptive Cadastral and Real Estate Rights data. Not only that the new Real Estate Cadastre system is developed on modern technology based on central Oracle database and WEB Java application but also with the workflow system supporting registration procedures for maintenance of Real Estate Cadastre data. The development of the new Real Estate Cadastre system started in January 2008 and finished in May 2009 including 6 month intensive testing of the system by the project implementation group established specially for this purpose from the side of Agency for Real Estate Cadastre. Also intensive training for the end users was done with special attention to the front-desk users that works with customers. At the end of the project the extensive acceptance test was made; more than 300 different procedures covered almost all possible cases, taken from the current production, were done. Test was executed by the end users from all departments that participate in the process of Real Estate Cadastre data maintenance and data issue. From May 2009 the system is in the phase of test production where all procedures for limited number of cadastral units are performed parallel in old and new system. The results are very good, so the plan is to start production on whole territory of sector Skopje with the June 1st of 2010.

Key word: Real Estate Cadastre, IT system, cadastre registration procedures, Land Cadastre, Buildings cadastre, Oracle, Java, Workflow, web application, digital certificates

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1. INTRODUCTION

The Agency for Real Estate Cadastre (AREC), Skopje (former State Authority for Geodetic Works, Republic of Macedonia) is an individual state body in charge of conducting the geodetic works and registering the real estate rights. Real estates are land, buildings, special parts of buildings and other objects, as well as other real estates which are registered in the real estate cadastre in compliance to the law. Real estate cadastre is a public book in which are registered the ownership rights and other real property rights, the real estate data as well as other rights and facts whose registration is stipulated by law.

In the past period, the Government of the Republic of Macedonia took a loan for the reforms of the real estate cadastre from the World Bank, thus enabling additional income for the introduction of the real estate cadastre in Republic of Macedonia. This project was focused to establish efficient real estate cadastre on the entire territory of the Republic of Macedonia. In the Strategic Plan of the Real Estate Cadastre Agency 2009-2013 (Real Estate Cadastre Agency of the Republic of Macedonia, 2008) the efficient IT system for the maintenance of collected data in the real estate cadastre is one of the most important tasks to be done. The current Real Estate Registry IT system, that covers only the descriptive Cadastral and Real Estate Rights data, is very outdated and technologically very limited. Especially security of data in the current IT system is critical; while based on the file system, there is no log of transactions and no information on executed procedures. So the goal was to establish integrated electronic cadastral information system, unique in the Republic of Macedonia that enables managing, updating, distribution and access to updated data from the Real Estate Cadastre. Based on ICT Strategy (State Authority for Geodetic Works, 2007) the AREC started with the project for new IT system for Real Estate Cadastre in 2007, while public tender was published. The primary goal of this new system was to develop efficient system for registration of technical and legal (ownership, rights) information about real estates based on new modern technology.

2. FUNCTIONALITY OF THE SYSTEM

The IT system for the Real Estate Cadastre was designed with the vision to obtain the next goals:

- to enable registration and supervision of cadastral procedures through the appropriate workflow system,
- to enable clients of AREC to be informed about the status of their case through the Internet,
- upgrading of existing cadastral system for maintenance of real estate cadastre data with improved data model with data integrity and application based on central database, web application and security standards and provide integration with workflow,

- to check and redefine workflow of existing cadastral procedures to obtain more efficient processing and security of data,
- the system developed and implemented for the AREC real estate center Skopje must be prepared to be used by other offices through the whole Macedonia.

At the start of the project the data model of existing system was analyzed first. The findings were that the current data model considering real estate data content for the basic entities (parcels, building, owners, encumbrances) is good, simple and efficient and enables interoperability between technical and legal aspect of data. Within the new data model moved from the file system to the relational database all these good things were preserved. Inside of the new data model first data reference integrity was assured consistently to protect system from discrepant data on the lowest database level. More structured data was involved for the parts of buildings and for encumbrances (leases, mortgages, restrictions, easements, etc.). Beside these improvements the history of data changes was involved into the data model; the data in this tables are filled automatically with the execution of the cadastral procedures inside the workflow module. Also what is very important is that in the new data model can be migrated all data from existing system, so no data will be lost when the new system will replace the existing system. The second part of the new data model that didn't exist in the old system is data model for the workflow that store data about cadastral procedures.

In the existing system was no data about execution of cadastral procedures, so the next step was to design module for registration of these procedures. In 2008 the new Law on Real Estate Cadastre (Law on Real Estate Cadastre, 2008) was adopted that changed some existing procedures, so the analysis of current cadastral procedures and the new law was a base for design of the workflow system. All the procedures were described and visualized in flow-chart diagrams. Sample of these diagrams from Project final report (IGEA, 2009) is presented in figure 1.

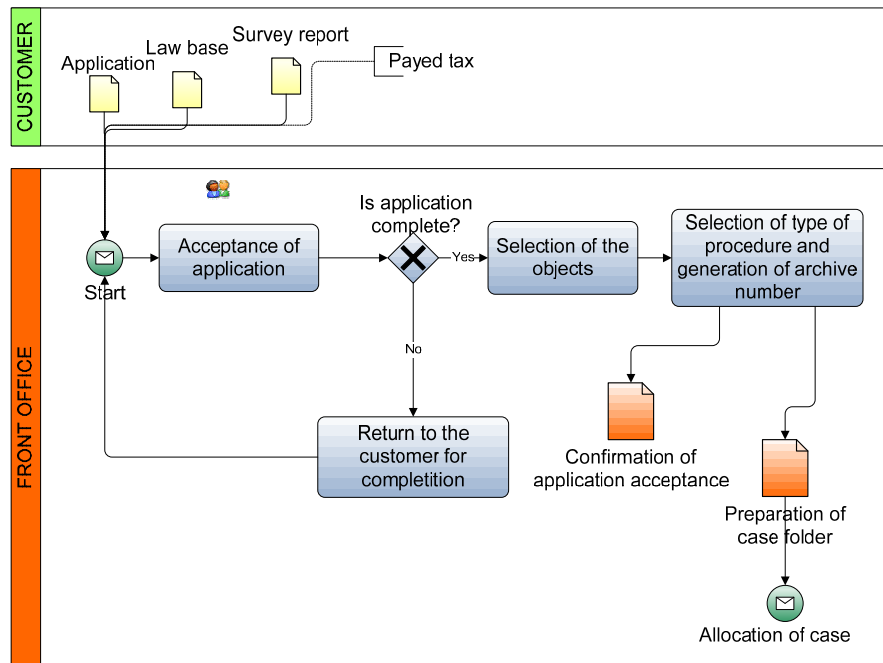


Figure 1: Sample of visualization of cadastral procedures – step 1: acceptance of application from customer

The workflow system supports all current cadastral procedures and covers all steps from the acceptance of the case from a customer to preparation of a final solution. The main steps in the procedure are:

- Acceptance of an application from customer at front-office; this consists of opening of a case with data about the customer, selecting of the objects (one or more parcels, part of buildings, encumbrances, etc.) and the type of procedure, calculate the tax and keep a record of the attached documents. At the end written confirmation for acceptance of the application is prepared by the system with all important data printed and paper case folder is prepared to keep all the documents linked to this procedure.
- Allocation of the case for solving to a corresponding officer in back-office is based on the type of procedure and location (cadastral community) corresponding to the internal organization of working groups.
- By maintaining of the data the system is very opened with minimum limitations and allows user very flexible work by entering of necessary changes in the system. The system helps user with presentation of old and new data at the same time in the very structured forms with additional controls on content, so the possibility of mistakes is minimized. The sample mask of application that presents old and new data is presented in figure 2. All changes are not entered to the valid database of the system but they are stored in database of workflow. At any moment the user can generate list of changes where old and new data are displayed and all changes clearly marked.

- Also workflow support exchanging of the case between the officers or departments if there is more subjects that participate in solving of the case. Before confirmation of changes detailed explanation for final confirmation is entered.
- By confirmation of data changes at the same time the data are stored in the valid database and the old data are moved to history tables. Beside this the documents for final confirmation and list of changes are prepared. Also, these digital documents are stored in the system linked to the executed procedure.
- With this the formal procedure is finished and the case can be stored in archive.

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Баранье Поступки КИС Статистика Систем Излез Помощ Шифрарници

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2 - Детелни податоци за решавање поступки
3 - Промена на КИС

Број на барањето: 1110-241/2009

Парцела Дел на зграда Сопственик Товар Прибелешка

Зтр.	Дел.З.	Кат. одд.	Кат. опш.	Бр.зр.	Бр.лрц.	Ил.	Викано.	Површ.	Волум.	Нам.
Дел на зграда (стара состојба)										
1	1	25 - СКОПЈЕ	167 - КАРПОШ	1	763	67676	AAAAAA	2500		СТАМЕЕНА ЗГРАДА - СТАН
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Додади

Продолжи

PostarkaPromenaKIS/ModulPromenaKIS.jsp

Figure 2: Sample of application that shows old and new data in the process of data changing

The system has integrated powerful modules for searching and viewing both the cadastral data and data about procedures; figure 3 shows application mask for searching procedures. Both are very frequently used in all phases of work. Also statistical module is developed for supervision of execution of cadastral procedures. The customer can follow the solving of his case through the internet application.

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Податоци за барањата: 315

Кат. одд.	Арх. бр.	Прием	Референт	Платено	Поступки	Тип на бар.	Завршено	Фаза	Док.
25 - СКОПЈЕ	1114-34/2009	05.05.2009 16:05:09	GKAEVSKI	Неплатено	1	Службен наод	05.05.2009 14:22:34	2 - Примено	
25 - СКОПЈЕ	1120-27/2009	05.05.2009 15:54:49	GKAEVSKI	Неплатено	1	Службен наод	05.05.2009 13:53:36	2 - Примено	
25 - СКОПЈЕ	1116-518/2009	05.05.2009 14:23:17	GKAEVSKI	Неплатено	1	Службен наод	05.05.2009 14:20:10	2 - Примено	
25 - СКОПЈЕ	1116-517/2009	05.05.2009 14:21:23	GKAEVSKI	Неплатено	1	Службен наод	05.05.2009 13:32:50	4 - Решено	
25 - СКОПЈЕ	1105-144/2009	05.05.2009 13:53:10	GKAEVSKI	Неплатено	1	Службен наод	05.05.2009 13:53:10	4 - Решено	
25 - СКОПЈЕ	1116-516/2009	05.05.2009 13:51:08	GKAEVSKI	Неплатено	1	Службен наод	05.05.2009 13:53:10	4 - Решено	
25 - СКОПЈЕ	1113-91/2009	05.05.2009 13:24:04	GKAEVSKI	Неплатено	1	Службен наод	05.05.2009 13:53:10	4 - Решено	
25 - СКОПЈЕ	1113-90/2009	05.05.2009 13:09:32	GKAEVSKI	Неплатено	1	Службен наод	05.05.2009 13:53:10	2 - Примено	

Податоци за постапките

Бр. на постапка	Шифра на постапка	Објект	Постапка	Референт	Датум на внес во листа	Фаза на постапка	Статус на постапка	Дет.
6017	2003	3 - Имотен лист	0 - Постапка	Goran Kaevski	05.05.2009 13:53:10	500 - Faza 5	1 - Завршена	

Figure 3: Sample of application that shows searching of the cadastral procedures in different status and presentation of results

3. SYSTEM ARHITECTURE

The new IT system for Real Estate Cadastre is designed and developed on modern technology based on central Oracle database and WEB Java application where special attention was put on security. Multilevel system is presented in figure 4 - Project final report (IGEA, 2009).

The core of the IT system for Real Estate Cadastre is central Oracle database. The Oracle 10 Database Standard Edition is used and for high availability the Real Application Cluster is implemented with data stored on SAN. Scanned documentation and documents generated through the application are stored on file system on SAN, also. Backup and recovery plan is prepared that enable the database can be restored to the last finished transaction. Data and documents backup is provided with DLT units that stores data on magnetic tapes, additional copy of database is periodical done on SAN and Oracle mechanism is used to log all transactions. By designing of the system also graphical data were taken in mind (even they are not part of this new system); it is planned to use ESRI ArcSDE for Oracle as database storage for graphical data.

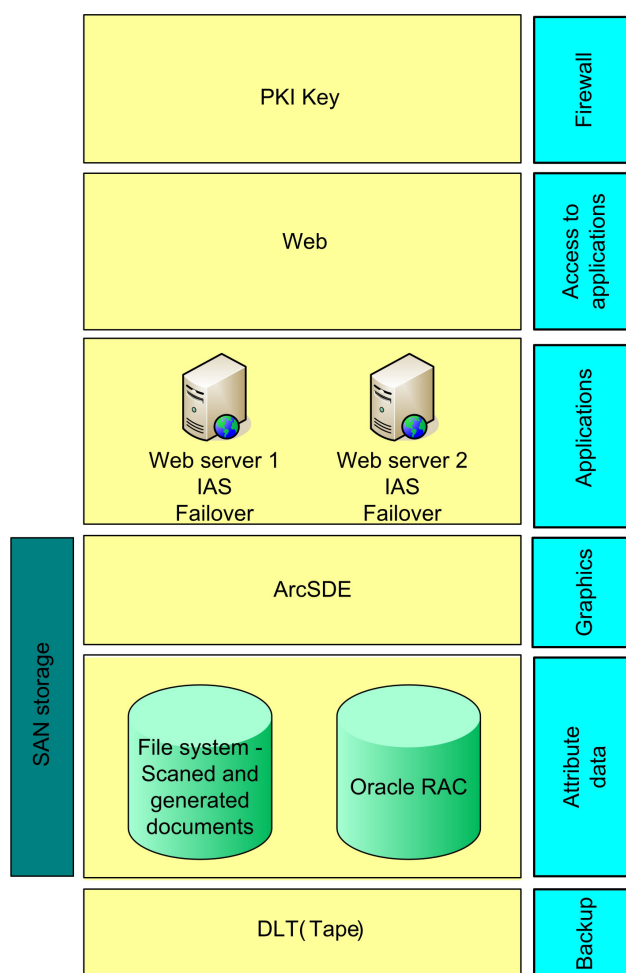


Figure 4: Generic schema of IT architecture

WEB application is developed corresponding to J2EE technology. To get high responsibility of the system all the business logic is defined through the PL/SQL procedures stored in the database itself. Oracle JDeveloper was used for developing java code that mostly cover user interface of the application. For generation of documents the Jasper report tool is used. Application is deployed on Oracle iAS servers, where Java virtual machine is created. At the moment 2 application servers runs and incoming requests are distributed between them through the HW Load Balancer. Figure 5 shows deploy of application on Oracle iAS application servers.

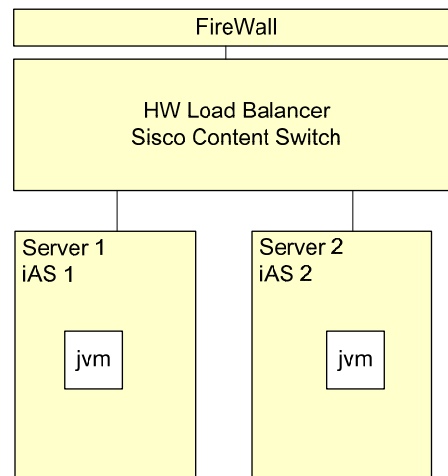


Figure 5: Deploy of application on Oracle iAS application servers

The security of the system is very important, so the 3 level security is included:

- The first level is authorization in the Oracle database itself. Access is allowed only for the application and for oracle DBA administrators.
- The second level is system of user rights management. Special system developed enable management of user and users groups and their rights into the system. Prepared interfaces return user rights to application for each user automatically recognized on the base of digital certificate and additionally verified with user password.
- The third level is using of digital certificates on USB PKI keys. Digital certificates used in the system are internal certificates of AREC and generated by AREC administrators. User must insert the USB PKI key in the workstation and enter the PIN of the key for the start of work with the system. On the base of digital certificate the system recognizes the user and request to enter password. System permanently checks for USB PKI key and in the case that is removed from the computer, the application stop to work.

All IT infrastructure that is designed to support 24x7 work is located at the AREC Head Quarters. Access to the system for the end users all around Macedonia is assured through the rented communication lines. For sector Skopje optical line capacity of 10 Mbit is provided. Because of reliability additional backup communication is provided through the internet that will still enable work but with lower performance. In figure 6 physical configuration of the IT infrastructure is presented - Project final report (IGEA, 2009).

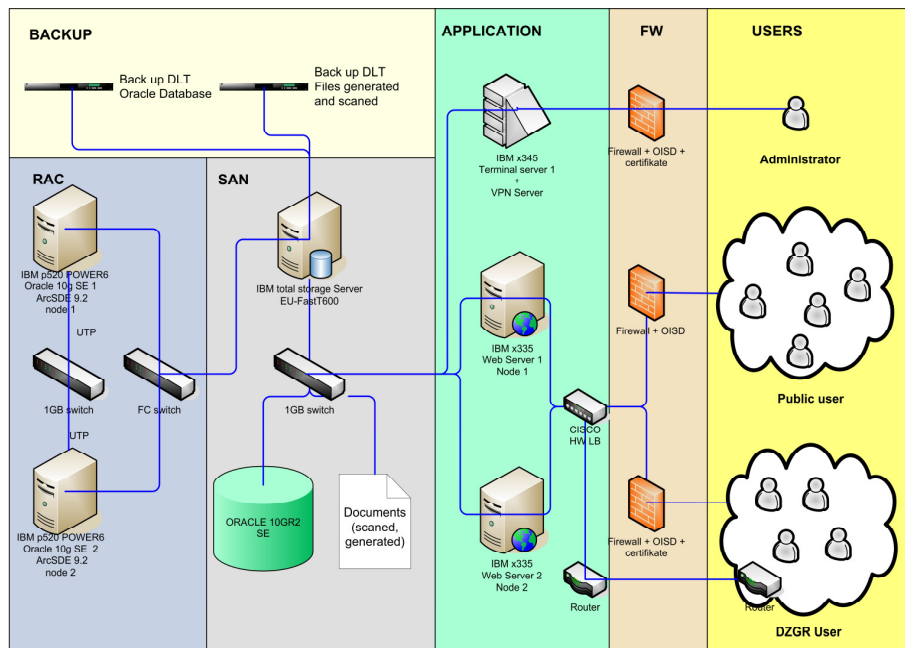


Figure 6: Physical configuration of the IT infrastructure

4. IMPLEMENTATION

In the project the implementation was focused only to sector Skopje. Implementation of IT system for Real Estate Cadastre practically started with final testing and verification of developed system. For this purpose project implementation group was established from the side of Agency for Real Estate Cadastre. This group participates in the testing of the system from the first versions of developed system in the end of 2008 and on daily base communicates with the development team. In April 2009 intensive training for the end users was done with special attention to the front-desk officers that works with customers. Training of the end user was done on selected typical procedures that were taken from real cases that were in solving at this time. At the end of the project in May 2009 the extensive acceptance test was made; more than 200 different real cases with more than 300 different procedures that covers almost all possible cases, taken from the current production, were done. Test was executed by more than 60 end users from all departments that participate in the process of Real Estate Cadastre data maintenance and data issue. The result of this verification shows that only 5 procedures can not be done through the system and some small upgrades to the system must be done through the regular maintenance of the system.

From May 2009 the system is in the phase of test production where all procedures for limited number of cadastral units are performed parallel in old and in new system. Through this entire time AREC project implementation group supports users in test production and executes additional training of new and existing users. The longer work

in test production shows that before the real production some upgrades to the system should be done, to make system more efficient and more user friendly. These changes are linked primary on more detailed structure of mortgage, encumbrance and loads of real estates, some simplification in execution of cadastral procedures, new document templates and searching the history data. The development of these upgrades were finished in May 2010, so the start production on whole territory of sector Skopje was started on May 31st of 2010. After successful start of production in sector Skopje, that covers almost 40% of all cases, the implementation of the system will start in other offices all around Macedonia.

5. CONCLUSIONS

The development and implementation of IT system for Real Estate Cadastre is long term process that starts in 2007 and as the situation stands at the moment it will be finished in 2011 with implementation of the system in all offices around Macedonia. The new system with detailed structure of all information, integrity of data, storing data about cadastral procedures, security of data and transactions, etc. means important step forward to the trustworthy of the Real Estate Cadastre in the Republic of Macedonia. Used modern web technology based on Oracle database and application servers, Java application and powerful IT infrastructure gives an assurance for the long term reliable work of the system and easy upgrading to the new requests. Also, the system is designed in the open way so that the further integration with the other systems and changes of cadastral procedures can be made very easy. In the future integration with central register of physical and legal subjects is planned and integration with graphical module for maintenance of graphical data must be done in very near future. Also integration of work of notaries and survey companies in part of preparation of data changes for the system is planned.

6. REFERENCES

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7. BIOGRAPHICAL NOTES OF THE AUTHORS



Dušan Fajfar, M. Sc. of Computer and Information Science, is IT Expert with more than 20 years experiences working on state level projects in Slovenia and international projects. As a project manager or project member there were conducted works in area of road management, public transport, real estate registers, emergency planning, civil protection and

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