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Updating Cadastral Data from distance using modern technologies

ABSTRACT

One of the main characteristics of a valid Cadastre is the procedure of updating the data. This can happen by using all the advantages of modern technology.

The updating procedures can be distinguished into three major categories, which are updating the descriptive data, the spatial, or combination of them. The descriptive data can be updated, via the Intranet, by giving access to authorized users. In that way, the users will be able to send the forms and inform the system about the changes. During changes of the spatial data an authorized surveyor should face the mutation of the land parcel by making use of modern technologies to survey the changes, either directly from the field, or from his office. The most usual case is the combination of the two previous cases, which requires both of the procedures. Since Greek Cadastral system is created for the very first time, it is an opportunity for Greece to implement modern technologies in order to update the cadastral data. This paper is a first approach of the issue in a theoretical level. The research on the subject will be continued, and hopefully a practical application of it will become true, even in an experimental phase, to begin with.

INTRODUCTION

One of the main and unavoidable characteristics of a valid, reliable and trustworthy Cadastral System is the process of maintaining and updating the Cadastral Data. Nowadays, the tenure and the update of the Cadastral Data should be performed my making use of the potentialities and the advantages of modern technology.

THE CADASTRAL DATA

The Cadastral data are data referring to the three basic cadastral objects, which are the persons, the land parcels, and the ownership rights of the persons to the land parcels. Therefore, there are cadastral data that describe the landowners. At the Greek cadastral Database these are the code number, the name, the parents name and the date of birth, the tax number, the identification data, the address etc. The cadastral data that identify the land parcels, in the Greek cadastral Database include information about the land parcel's code number, it's area, coordinates, use and address elements. The cadastral data that determine the ownership rights, involve information about the cadastral number of the land parcel, the right holder, the type of the right, the acquisition title, the percentage of the right, etc.

The cadastral data can be distinguished into two major categories, which are the descriptive, and the spatial data. The descriptive data are the data that describe and identify the land tenure as well as the land right holders. According to the Database of the Hellenic Cadastre, the descriptive data are the data of ownership rights including the elements of vertical ownership, condominiums, collaterals, attachments of real property, leases, easement. Moreover, the descriptive data describe the land parcels. Finally, the descriptive data include the elements of land right holders. The spatial data are the data that designate and identify the land parcels. The types of spatial units can either be points, lines or polygons, but all of them are expressed by coordinates.

The updating procedures of the cadastral data, as it is shown on the figure 1, are classified according to classification of the cadastral data.

Therefore, the first category is updating the descriptive data, which is linked with the legal side of the Cadastre. The second category is updating the spatial data, and it deals with the mutation of the land parcels. The term mutation implies the process of changing the boundaries of a land parcel. In other words, changes, involving the creation of new parcels of land, whether by a process of subdivision of previously existing units, are termed mutations. Hence, in any alterations of the shape, the position, or the boundaries of the land parcels the system is facing a spatial change. (Simpson, 1976). This category is linked with the technical nature of the Cadastre, and hence it requires the contribution of surveyors.

The most common category of updating the cadastral data is the third one, which is the combination of the above, the simultaneous change of both descriptive and spatial data that requires the cooperation of notaries and surveyors in order to de accomplished. (Arvanitis, Koukopoulou, 1999)

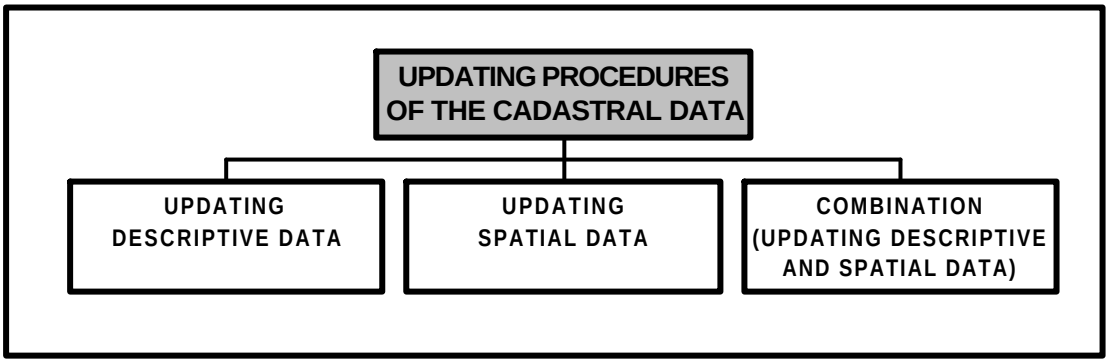

Figure 1: Classification of the Updating Procedures of the Cadastral Data

As it has been said above, once a cadastral system is being created the updating procedures are a necessary factor for a proper and complete operation of the system.

IMPLEMENTATION OF TELEGEOPROCESSING INTO UPDATING THE CADASTRAL DATA

TeleGeoProcessing is a term defined like *'a discipline merging GIS and telecommunications in order to support decision-making'* (Laurini, 1999). TeleGeoProcessing can be implemented in Updating the Cadastral Data Procedures. In other words, the data an be send to the cadastral system, throughout a modem in an authorized user's computer, or directly form the field, by means of wireless telecommunications like cellular phones or wireless modems, which will be adapted on the surveyor' s Field GIS.

The basic components of a Cadastral System that makes use of modern technologies in order to be kept updated are the clients, the means, and the cadastral GIS. The **clients**, by using the **means,** will perform the updating procedures in order to alter the cadastral data that are included in the **Cadastral GIS.**

First of all, the system requires the contribution of general public who has interests in land, like landowners, land buyers, public organizations and so on, for example, people who want to perform a change, like a land transfer for example. Moreover, between the clients of the cadastral system are included the authorized users, who are the persons who will have access to the database, and who will suggest the change of the cadastral data. The authorized users will be surveyors, notaries, etc. At this point it is important to notice the fact that the one who will actually perform the change of the data, which will have been suggested by the authorized users, will be the administrator user. He will be responsible for the alteration, and he will also keep the historical data. The general public will have the right to communicate with the system in order to retrieve cadastral information, but not the right to access into the cadastral database and alter the data.

Another basic component of the cadastral system is the means that will turn the whole procedure into reality. The means are indeed the implementation of TeleGeoProcessing in Updating the Cadastral Data Procedures.

First of all, the LAN (Local Area Network) which will be a basic element of the system. The LAN will include all the authorized users who will use Intranet and Client / Server technology. The system should operate through Intranet and not Internet basically because of the lack of security that characterizes the Internet comparing to Intranet. Moreover, is easier to share information through Intranet, and finally, the system will be referring only to authorized users, so there is no reason why Internet should be preferred.

The system will operate using Client / Server Technology. Client / Server is an architecture in which a system's functionality and it's processing are divided between the client PC (the front end) and a database server (the back end). The front end user uses the front-end application to request information from the database server. The database server receives these requests, process them, and sends the results back to the client to be displayed. The back end handles all the global data manipulation tasks, like searching, shorting, storing and security. Client machines communicate with the server across a local area or wide area network. Due to the large needed capacity in order to store and maintain a Cadastral Database, plus the complexity and the big number of different kind of updating procedures, there is a big possibility that more than one server will be needed. There will be a complete Client / Server system that will involve more than one server. Each server available on the Client / Server system may handle a specific function. The benefits of choosing a Client / Server system are numerous. First of all, it provides the users with easy and improved information access, plus with automated workflow processes. Moreover, because the information in a client server system is stored in a relational database, the data can be easily queried. Furthermore, a Client / Server system offers the possibility of an improved customer service, with the potential of rapid application development. Finally, a well organized Client / Server system reduces the cost in a number of ways. (Jenkins, 1996).

All the data that will be sent to the server using networking protocols. Protocols are a set of specifications and software controls that manage the physical, the data link, the network, the transport, the session, the presentation, and the application layer of the Client / Server system's operation. There are a lot of widely known protocols, like XNS (Xerox Network Devices), IPX (Internet Exchange Protocol), AppleTalk that connects Macintosh computers with other network devices, DECnet, SNA (Systems Network Architecture), ARCnet, Token Ring which is invented by IBM, and Ethernet or fast Ethernet, which is the most popular LAN protocol. Even though, there is one more type of protocol that is fast becoming the de facto industry standard for client/server applications. That is TCP/IP (Transaction Control Protocol/ Internet Protocol), and it is used by the most popular field- GIS devices. TCP/IP is the default protocol in UNIX Systems, and it turns out to be the protocol of choice for multivendor, heterogeneous platform systems integration. Because, high volume, transaction oriented client server applications usually run on UNIX – based database platforms, TCP/IP has been established in the field of client/server technology. For all those reasons, a TCP/IP is preferred and recommended for a Cadastral System Application. (Jenkins, 1996).

The spatial data collection will de performed with acquisition devices. These are the EDM and the GPS, which are used in order to survey the spatial changes. Then, the surveyor uses another device that is called 'Field GIS' or 'Hand Held GIS'. This is an import – export palmtop related with the Cadastral Database by means of wireless telecommunication. Field GIS can operate almost any popular shapefiles, like AutoCAD files, dxf, Esri shapefiles, tiff and bmp map image support files.

The telecommunications will play a very important role as well. The data will be send to the cadastral system, either from the notary's or the surveyor's office throughout a modem in his computer, or directly form the field, by means of wireless telecommunications like cellular phones or wireless modems, which will be adapted on the surveyor' s Field GIS.

Another basic component of the cadastral system is the Cadastral GIS. Inside the GIS all the cadastral procedures take place. The cadastral procedures are the data acquisition / collection, the data processing, the organization of the system and the dissemination of the data. The cadastral GIS consists of the cadastral map and the cadastral Database, which include the cadastral data. The cadastral data are separated into the spatial and the descriptive data, a classification that has been analyzed above.

At the next units two characteristic examples will be analyzed. The first one will regard the procedure of updating the descriptive data, and it deals with the land transfer of a land parcel's ownership. The second example will concern updating both spatial and descriptive data, and it deals with the subdivision of a land parcel.

FIRST EXAMPLE – LAND TRANSFER

The example of land transfer is considered to be one of the most characteristics updating procedures of the descriptive cadastral data. In that case, the suitable scientist to face the alteration is a solicitor or a notary, because of the legal nature of the procedure. When the procedure takes place in Greece a notary is entitled to draw up a deed. The way in which the whole procedure should be faced will be analyzed. It is shown on figure 2.

To begin with, the clients involved in this specific updating procedure, are the landowner, the land buyer, and the notary. The landowner and the land buyer should address to a to a notary and inform him that the owner wishes to assign the ownership of the land parcel to the buyer. Then the notary will perform the legal check, and after that, he will draw up the deed of the transaction.

The notary, who will be a main user of the system, will use his PC, which will be a part of the LAN, in order to inform the system about the change. The descriptive data can be updated via Intranet using pre-constructed forms through a browser-faced interface, which will give access to authorized users. The browser-faced interface, according to the user needs at the time, with pre - constructed forms, will automatically lead him to the proper server. Through that the notary will submit the attributes of the deed to the system.

When the system receives the new data from it's client, then the Administrator, who will be responsible for the changes in the Cadastral Database, should check out the form in terms of correctness, completeness and validity, and afterwards, he ought to keep historical data, and perform the change. After the alteration of the data, the server must provide the landowner with the new title.

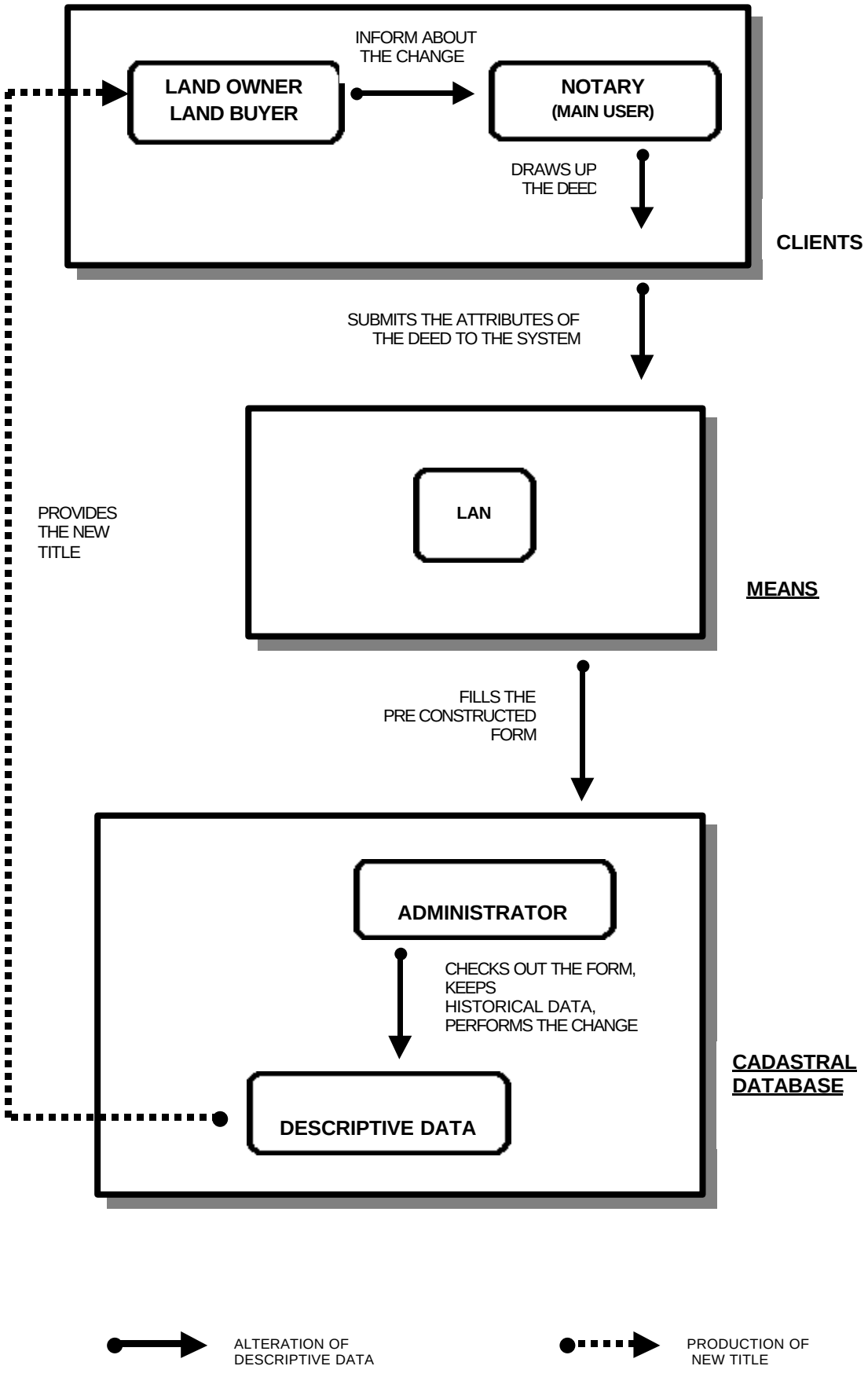

Figure 2: The process of the land transfer

SECOND EXAMPLE - THE SUBDIVISION OF A LAND PARCEL

The example that will be examined as an indicative case of updating both the descriptive and the spatial data is the subdivision of a land parcel into two new land parcels. The owner of a land parcel decides to subdivide it, in order to transfer the land ownership of half of the initial land parcel to another person. The descriptive data will be altered, since the landowner of the initial land parcel will transfer his ownership rights to a new person, called land buyer. The spatial data will also be altered because a new boundary line that separates the two new land parcels will be created at the cadastral map.

The updating procedure is shown in figure 3.

The landowner and the land buyer should address to a notary. The notary should examine the case, perform the legal check on whether the spatial alteration is allowed by the law. Assuming that there is no legal restriction, the notary should draw up the deed, and, as an authorized user of the system, he should submit the attributes of the deed to the system from his PC, which is a part of the LAN of the system. Of course, he will do that by using the Client / Server technology for the cadastral updating procedures, which have been described analytically above.

The next step is the examination of the procedure by the cadastral system. Independently whether a private or a public organization will operate the system, an administrator user of the system should examine the application and decide whether it demands field survey or the data can be updated by the surveyor's office. Either way, the administrator, assigns the procedure to an authorized surveyor, who is another client of the Client / Server cadastral system.

Then the surveyor must deal with the alteration. The procedure he will follow depends on the nature of the spatial change. If the fieldwork is not necessary, the surveyor can perform the change from his office, just by filling the pre-constructed form that is associated with his exact type of change, of the Cadastral Server. If the change demands fieldwork, then the surveyor should visit the area and survey the spatial changes, using GPS or EDM. Then, he may use 'Field GIS' to inform the System about the spatial changes. Either from his office, or directly from the field using TeleGeoProcessing means, the surveyor's next step will be to send the updated data back to the cadastral system, in order to inform the system about the subdivision.

Then the Administrator, responsible for the changes in the Cadastral Database, should go through an approval process, as he should check out the form, as well as the survey, in terms of correctness, completeness and validity. Moreover, the administrator should perform a check on whether the spatial cadastral standards have been kept. Afterwards, he ought to keep historical data, and finally perform the change in both the descriptive and the spatial data.

After the alteration of the data, the server must provide the landowner with the new cadastral map of his land parcel that has been altered, plus with the new title.

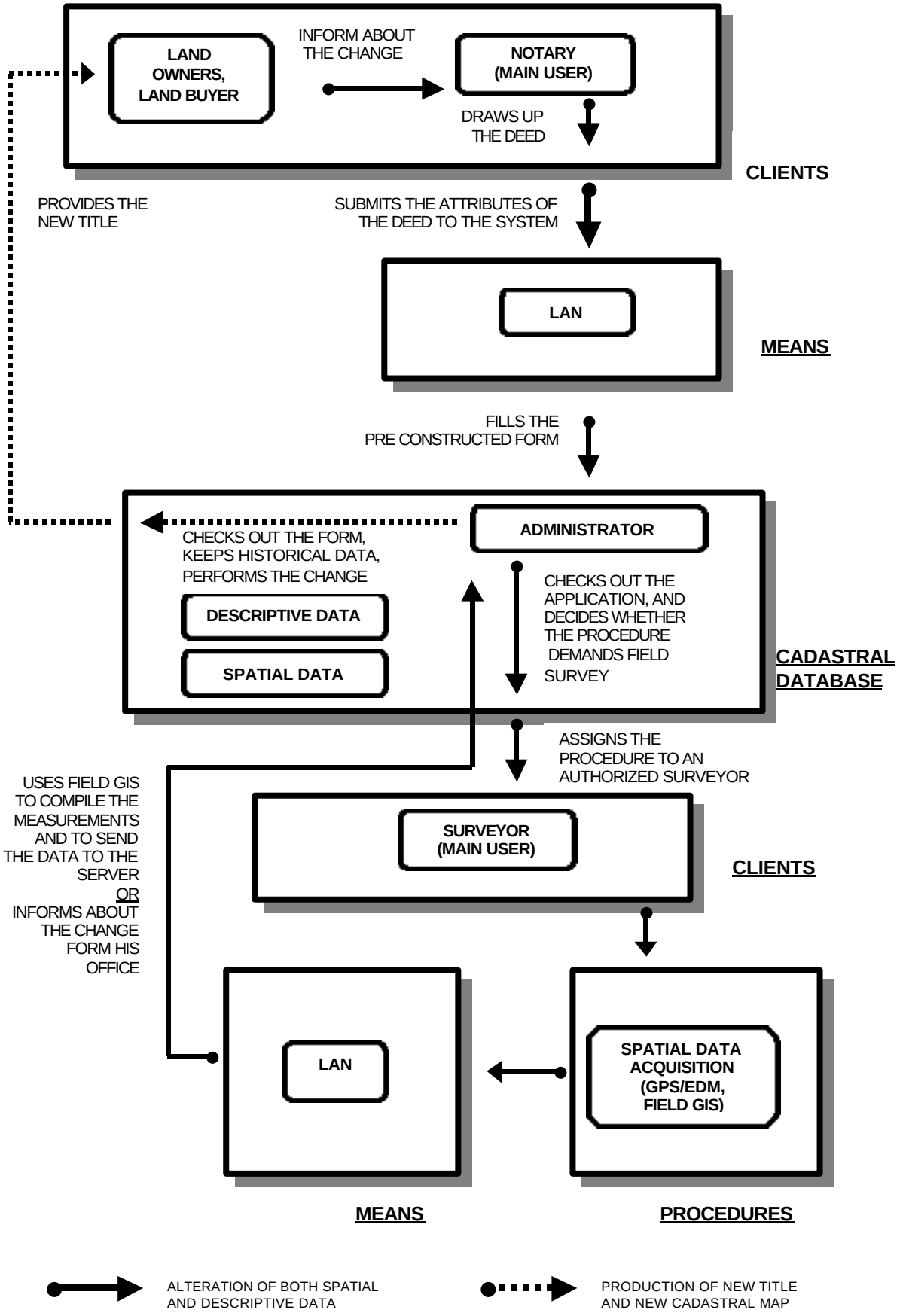

Figure 3: The process of subdivision of a land parcel.

CONCLUSION AND OUTLOOK

This paper describes the way how modern technology can contribute to the updating procedures of a reliable Cadastral System. Modern technology offers a great potential in terms of security, speed, automation and standardization. Those abilities must be tuned to advantage in order to face specific cadastral procedures. In this paper, we have given characteristic examples and we tried, by using a simple and comprehensive way, to show the way in which the updating procedures should be faced. Other procedures can be handled with a similar way.

Another topic that should be pointed out is that the cadastral data do have legal nature. Therefore, the confirmation of all the updating procedures by an administrator user who will be responsible for the data maintenance is obligatory.

Since Greek Cadastral system is created for the very first time, it is a great opportunity for Greece to implement modern technologies and to take advantage of their benefits in order to update the cadastral data. Unfortunately, the way how the Greek Cadastral Data will be updated has not been predicted so far. The need of establishment technical standards that will define the issue is obvious, and Greek cadastre will have to face that need very soon. Nevertheless, this paper is a first approach of the issue in a theoretical level. The research on the subject will be continued, even in an experimental phase, to begin with.

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