SICC: An Exchange System for Cadastral Information
(Extended Abstract)

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1 Introduction

We present and discuss in this paper the major issues we faced during the design, prototyping and implementation of the "Sistema di Interscambio Catasto-Comuni" (SICC), namely the system for italian cadastral data exchange among the principal entities interested in Italy to the treatment of cadastral information, that are Ministry of Finance, Municipalities, Notaries, and Certified Land Surveyors.

The definition and design phases, conducted with the direct involvement of all communities interested to cadastral data, allowed to identify a new and promising approach, namely the *access keys warehouse*, for the realization of large distributed spatial applications that have the absolute requirement of integrating legacy spatial databases.

2 Starting Point and Objectives

Cadaster, a Department of the Ministry of Finance, in the italian situation is the public registry of the real estates and land properties. It was established for fiscal purposes. The access key in Cadaster to data about real estates and land properties is expressed in terms of a unique cadastral identification code, made up by Municipality code, map sheet number, parcel number and flat number.

A Municipality has the objective of planning and managing land use. For this purpose it mainly uses two keys. The cadastral identification code, as above defined, and the property location expressed in terms of street, civic number, and flat number.

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From a physical point of view, Cadaster data is managed by the Land Department of the Ministry of Finance through its Land Offices ("Uffici del Territorio") that are present at the level of Provinces (one Office for each Province), which are a subdivision of the main administrative partition of Italy in Regions and an aggregation of Municipalities.

The Ministry of Finance, as required by the law, uses cadastral data to keep record of and to certify location and planimetry (i.e., flat layout) of properties. Note that, according to italian law, taxes on real estates and land properties have to be based on their cadastral value ("rendita catastale"), computed on the basis of a number of objective parameters depending on the property characteristics. General parameters always used are the size and the location of the property. Once values for such parameters are know the cadastral value is automatically computed. The Ministry of Finance is currently evaluating a proposal to introduce also parameters related to the market value of the property.

Furthermore, through its Estate Public Registry Offices ("Conservatorie Immobiliari"), the Ministry of Finance also keeps record of and certify ownership rights and mortgage rights relative to properties.

Municipalities also have their databases about real estates and land properties. These are used, as set by the law, to support and manage actions in the sectors of Toponymy, Local Fiscality, Public Works, and Land Management.

Size of data bases managed by Municipalities is largely variable, considering that about 6.000 of the 8.102 italian municipalities have less then 5.000 citizens, but 8 of the 20 Region chief towns have more than one million inhabitants.

It is clear that there is a continuous exchange flow of cadastral data among Municipalities, Ministry of Finance, Notaries and Certified Land Surveyors. Currently this flow of cadastral data happens mainly by means of an exchange of papers.

Note also that cadastral databases are not managed at a single central location but at the more than 100 Land Offices of the Ministry of the Finance. This means that there is not a single centralized system, but more than 100 systems, geographically distributed over the whole italian territory.

The cadastral databases contains about about 300.000 maps, approximately one third of it is in an electronic form, and about 1,5 millions of geodetic reference points. These maps ("Catasto Terreni") are the geodetic reference for land parcels and for the planimetry of the building possibly existing within land parcels. The planimetry of various flats inside the building is recorded, together with other descriptive data, in "Catasto Fabbricati" and has not a direct geodetic reference.

Typical inquiries on cadastral databases ask for certificates needed by notaries in all sale acts and buyers pay a fee to obtain them from the Cadaster. Usually the certificate is about location and cadastral value. Additionally, topographic and geodetic information (for land parcels) or planimetry (for real estates) may be asked.

Note that data of geometric type are often required during sale transactions to check if the current situation of the land property/ real estate is coherent with respect to to the situation recorded in the cadastral databases.

Every year in Italy there are about 1,5 millions requests of cadastral certificates and in one of the largest provinces there are about 100.000 yearly requests.

Updates to cadastral data bases are requests to change, for a given real estate/ land parcel, some piece of information of geometric nature or of descriptive nature. They can be related to the creation of a new building (with its flats) in a land parcel or to the variation of an existing building or flat or to the change of some descriptive data (e.g., the owner).

The number of yearly geometric updates to cadastral databases is about 250.000. These updates always triggers further updates, since a change affects one or more of the following aspects: property rights and mortgage rights, fiscal nature and parameter values, destination and allowable usage.

In 1995, the situation was the following :

– cadastral data recorded in Cadaster are not, in general, up to date with cadastral data recorded in Municipalities, and both are not, in general, exactly describing the situation in reality. It has been estimated through a sample of 5% of the overall data, that about 40% of the whole set of data held in cadastral data bases is not up to date with the reality. Please note that this refers to the *overall* set of data, including both data generated by the cadastral offices and data received from the outside. Data generated inside cadastral offices are usually up-to-date, hence the Cadaster is able to perform its main role. The greatest source of incoherence is in data received from the outside, and the consequence of this is a great difficulty to establish a reliable correlation between a situation represented in the cadastral databases and a situation represented in databases of other organizations.
– the way cadastral data change as consequence of actions taken by municipalities, on one side, and by the Ministry of Finance, on the other side, are usually different. This is the main reason for the lack of correlation between data held by Municipalities and data held by Ministry of Finance, notwithstanding the large efforts that are periodically taken to force the correlation. It has been estimated that about 10% of the overall data changes every year.

To deal with coherence maintenance issues in cadastral data exchange, as required by the law [1], AIPA started in 1995 the SICC project [2–5], with the participation of Ministry of Finance and ANCI, the association of italian municipalities.

The overall objective of the SICC project was to provide technical tools to overcome this situation without affecting the current relations and kind of interaction among interested entities and without changing their inner work organization.

At the same time, law required an organizational change towards a decentralization of activities. But this had anyway to be implemented in such a way to keep at the center the roles of validation and high-level control for cadastral information.

3 Our Solution

It is clearly not possible to proceed in such a situation with an approach based on building new spatial databases, even if the database is distributed and based on a "federation" concept. In fact, this would require a huge amount of resources and would not satisfy the need of keeping the current system working for the everyday needs of citizens.

Also, an approach based on the usual "data warehouse" concept would not be adequate, given the high dynamicity of data and the strong emphasys on the certification purposes of the overall system.

Hence we defined and used in the SICC project the concept of **Access Keys Warehouse**. This approach is conceptually simple but it has shown in the SICC project its high effectiveness.

With this approach a *data repository* containing all data items that can be found in various databases of a distributed systems *is set-up only from a virtual point of view*, while data items remains at their physical locations.

An Access Keys Warehouse is then made up by two main components (for more details see [6, 7]:

- An *exchange identifier database*, that is physically built and contains *access keys* and *logical links* for data items in the various databases of the distributed system. The access keys are attribute names, selected from the existing attributes in the underlying databases: the main rule in order to select them is that their concatenation constitutes a unique identifier for the data item. Logical links provide the access paths to the physical (distributed) databases where further data elements about the identified data can be found.
  Note that attributes in the exchange identifiers database act towards legacy systems as access keys: their value is used to query legacy systems. Hence they are **not** physical pointers, and the legacy systems maintain their independence and transparency both with respect to location and to implementation.
  The exchange identifier database is populated using data existing in the various distributed locations.
- A *coherence manager*, that is triggered by updates occuring in the various databases of the distributed system. It activates data and control flows towards the distributed locations so that the various databases can be kept up to data as a consequence of a change happened to a data item in a specific location.

The use of the Access Keys Warehouse concept fully supports the SICC project targets, since it allows to progressively synchronize the various distributed databases. This increase in database correlation then means that data manipulation can be more and more de-centralized towards municipalities while keeping a central high-level control.

The first prototype of the SICC project was implemented in 1995 by AIPA and the italian National Research Council. This prototype proved the feasibility of the technical solution and of the organizational model proposed.

Then SOGEI, the italian company managing the computerized information system of the Ministry of Finance, developed a second prototype, with a better degree of integration among cadastral data and services. This prototype has been put into operations in peripheral offices of Neaples municipality in May 1997.

It was then subsequently validated, through the involvement of about 100 Municipalities ranging from Region chief towns to very small ones and a small sample of notaries and certified land surveyors, for about one year.

Finally, in September 1998 the engineereed system, named SISTER [4] and developed as well by SOGEI, has been put into nation-wide operation.

Access to the system is through a WEB-based interface and the effectiveness of its use is demonstrated by the sharp increase of requests managed by it during the first months. In the month of January 1999 there has been already more than 100.000 cadastral certification queries. Remember that such a query is usually paid by its final user.

The final phase of the whole project is running in 1999 and aims at extending the range of services provided to end users.

It is as well planned to use the *Access Keys Warehouse* approach in the implementation of other large distributed applications for the italian Public Administration, that are currently in the definition phase at AIPA.

References

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