IDERioja. CORPORATE MANAGEMENT OF SPATIAL DATA INFORMATION. A FACT.

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The Government of La Rioja (Spain) initiated in the year 2003 the so called IDERioja Project, which main objective was to design a corporate administration of spatial data by means of Oracle Spatial and its use in geographical and management applications.

The solutions offered by commercial geographical software allow the use of the DBMS but they cause serious difficulties to other computer programs in the management of spatial data.

The use of proprietary formats, the administration of DB resources without user notice, or the generation of criptic metadata tables, is a general practice which limits the spatial data management.

The IDERioja Project, developed by its own computing services company (SAICAR), tries to reach an absolute independence between the geographical data and the software which manages it in order to avoid being constrained to an interest area.

The different aspects which define the SDIs development have been taken into account in our design.

1. BACKGROUND

The Government of La Rioja (Spain) has got a Geographical Information System since 1989 which has been growing and adapting according to the technological development until becoming a corporate system, by means of a file server accessible to all technicians who need spatial information. This system has an internet version at www.larioja.org/sig

The recent possibility of integrating spatial data inside database management systems (DBMS) offers the opportunity to deal with more ambitious objectives from the point of view of their integrity and coherence.

This circumstance motivated the start of the IDERioja project in 2003, which main measures was aimed towards the corporate treatment of spatial data both in geographical and administrative contexts. This project can be internet accessed at www.iderioja.org

The achievement of this goal involves the need of making spatial data and geographical software as much independent as possible, and also the direct management of the data model including reference integrity, topology and coherence of the database.

2. DESIGN OF THE SPATIAL DATA MODEL

Being able to manage spatial data inside a database environment allows the total integration of those data with the rest of applications, although the way and area from which the data model is defined will greatly determine its future use.

2.1 Data Model definition from a geographical environment

Defining the Data Model from geographical tools is a fast, easy and convenient option so that is the most usual way to proceed.

In this case, aspects concerning spatial topology and reference integrity of the data model are defined in a higher level than of the relational database itself, even implementing spatial entities that have nothing to do with the database or using binary formats and indexes not recognized by the rest of applications.
Proceeding with this way determines spatial edition to use the same geographical tool that generated the data model, or in the best situation to use API’s provided by the manufacturer, so exploitation of geographical data is severely constrained.

On the other hand this procedure demands giving the geographical tool extraordinary administration permissions over the database, which is not considered correct by database administrators.

Creating data models with geographical tools usually involves making restricted tables or dictionaries inside the own database. This tables which structure, name and content is cryptic for the rest of the applications, are needed for the proper managing of spatial information with the computer tool.

2.2 Defining the spatial data model from the DBMS environment

Defining the Data Model from the database environment is a much slower and inconvenient procedure than the previously described, and strict controls about topology, coherence and integrity of the database is also demanded of the designer.

If we want the spatial model to be accessible for different geographical tools it is necessary the internal maintenance of the tables or data dictionaries that these applications need to access and edit spatial data.

In contrast the spatial data warehouse will potentially be accessible and editable by any computer application both geographical and administrative, without being constrained to a particular software.

In this case all permissions for creating tables, indexes and complementary tables are under the sole control of the database administrator.

2.3 General aspects relating the design of IDERioja spatial model

The previously stated reasons, that condition the method of defining and managing the spatial model, have led the Government of La Rioja to board its definition from the own database administration environment.

The necessary compatibility of spatial data with commercial software is achieved in this case by the parallel maintenance of the tables required by each software, which is made using triggers associated to the tables. By this way spatial data edition is totally independent of geographical software.

Reference integrity is kept using constrains and triggers also associated to every spatial table and taking part in maintenance of topology.

Direct managing of the data model also allows the use of more than one geometry associated to every record of the tables, which can be used to maintain different versions of the geometric descriptions according to scale or coordinate system.

The structure of tables, their spatial indexes, relationships and integrity are defined by the administrator as part of the database, so that integration and definition of the spatial data model is not strange to the structure of the information system but a specialized part of it.

Guidelines of the European project INSPIRE (the Infraestructure for Spatial InfoRmation in Europe), regulations of the European development of spatial data infrastructure (IDEs/SDIs) and different rules of the ISO 19100 series have been considered in the design of the system

Different applications have been developed in Java (J2EE) to make the access to system administration and data model managing and also the consult and edition of ISO 19115 metadata easier, which are accessible from internet.

Access to spatial data is also available through internet by means of a WMS service which is Open Gis Consortium (OGC) compatible, and a SVG viewer that allows interactive consulting of spatial and tabular data of the DBMS with external OGC data altogether.
3. ARCHITECTURE

Architecture diagram:

4. DATABASE ORGANIZATION

4.1 Database users

It has been decided that a single user is the owner of all the objects in the spatial data infrastructure system. This is the detailed account of users:

- ORACLE administrators: SYS and SYSTEM.
- Spatial ORACLE administrator: MDSYS.
  MDSYS is the owner of geographical tables and procedures in ORACLE.
- GeoMedia administrator: GDOSYS.
  It is the owner of the tables of the particular dictionary of GeoMedia. This dictionary must be updated with information relating to geographical information tables, placed in ORACLE.
- Other geographical software administrators.
  For the moment compatibility with ArcSDE is being studied.
- Spatial data infrastructure administrator, IDERIOJA, will be the owner of any object with geographical associated information.
- System users. These are the registered users, that will access the system for its maintenance and consult. The web application provides procedures to add users and permissions.
  It is not necessary to be a registered user to access the web viewer.
4.2 Objects nomenclature

The existence of a single ORACLE user who manages all the objects related to spatial information makes difficult its location and classification. Strict nomenclature rules for database objects have been designed in order to avoid this problem.

4.3 Authorizations

Related to user structure of the database, the authorizations schema is sketched this way:

- SYS, SYSTEM, MDSYS users and geographical software administrators. They have got full permissions in ORACLE having the DBA role assigned or equivalent privileges.
- IDERIOJA user. The administrator of the spatial data system is the control user of the system and also the owner of the objects. This user creates system users and grants permissions.

Creating tables with geometry in ORACLE involves updating tables and dictionaries of geographical tools, so it has been necessary to grant IDERIOJA privileges over the objects of geographical software administrators.
- Users who edit spatial data with geographical software also need access to dictionaries but with less privileges than IDERIOJA, so:
  CONEXIÓN role is created, with read only privileges over tables and geographical dictionaries.
- Final users. They are all editing and consulting users, both for the web application and for different geographical tools.
  - They do not store information in their own tables.
  - They use ORACLE only as a password repository.
  - According to the kind of users, they will have the following additional permissions:
    - For accessing the web application they are assigned menu functions through group profiles.
    - For cartography maintenance using geographical software, it is necessary to grant privileges, using roles, for the objects (tables and sequences) that are needed. And also assign the role CONEXIÓN defined by IDERIOJA user.

4.4 ORACLE resources

The use of different tools for the access and maintenance of the spatial database has required the need of using different ORACLE functions:

- Reference integrity. The update of database is made from different environments. Firstly from the web application and secondly from geographical tools for spatial and alphanumeric data.
  To preserve data coherence, validation and information structure it has been delegated in ORACLE and not in third party tools the guarantee of such controls, intensively using constraints and triggers.
  Common functions assigned to reference integrity are:
    - Not null data, primary key, foreign key and unique data restrictions are applied with constraints.
    - Data format and completion validations are programmed with triggers.
    - ORACLE dictionaries remarks. Some geographical tools allow users to show remarks of tables and columns existing in ORACLE dictionary.

5. SOFTWARE COMPONENTS

5.1 Web application

It is programmed to be used entirely from internet. The web application is the administration tool of the whole information structure, except for spatial data.

The system is made up of the next modules:
5.1.1 Users and menu functions.

This module has as an objective, the administration of system users and the configuration of the application menus, customized by the user.

- Users. Maintenance of system users. Passwords are stored in ORACLE.
- Applications. Covers applications tables, menu functions for each application, groups for an application and functions assigned to groups of an application.

5.1.2 ORACLE and GeoMedia monitor.
The monitor has got as primary objective the simplification of the understanding of the storage system of spatial objects for designers and system administrators.

- **GEOMEDIA.** It allows access to all metadata dictionary contained in GDOSYS user, which needs that tool to interact natively with ORACLE.
- **ORACLE Spatial.** Show the content of tables of the administrator user MDSYS.
- **ORACLE.** It allows consulting the environment of the database in several aspects both static (dictionaries, parameters, ...) and dynamic (activity, sessions, ...)
  - I/O Activity, storage, cache, dictionary, statistics, instance.

### 5.1.3 Utilities.

Very important functions for operating the system are included in Utilities:

- **Parameters.** General use values for the system are specified.
- **Texts.** Maintenance of remarks of the database used in the application.
- **Oracle Authorizations.** Contains the procedures to grant users that edit geographical information permissions for consulting/maintenance using Oracle roles.
- **Audit.** Entities with personal information will be audited by Oracle.
- **Special tools for creating and maintaining spatial indexes.** Provides several tuning functions for Spatial Oracle.

### 5.1.4 Map viewer configuration.

The main function of this module is configuring consults. Its content is:

- **Consults:** Contains the name of the consult, the coordinate system in which it will be represented and the maximum range layer that will determine the initial representation.
Layers of the consults: For each consult contained layers are enumerated, their priority established and also the content of the *where* clause of the SQL sentence.

Columns of the layers of the consult: Columns of a table or SQL expressions can be defined, for example to calculate the area of a council.

Styles of the layers of the consult: For each layer the style code in which it will be displayed. For thematic layers a style can be defined for each interval.

Viewer of the consult: it allows the display in the viewer of the selected consult.

The rest of the information in this module refers to tables of auxiliary codes.

5.1.5 Geospatial information (INSPIRE).

Catalog. Definition of all layers with spatial information, contained in tables and views of the database.

Appendix I and II. Information is arranged following the proposal for a guideline of the European Parliament of July 23, 2004, which establishes a spatial information infrastructure for the European Union (INSPIRE) according to its appendixes I, II and III.

Geographic coordinates of the element (LOGROÑO) and graphic view of the registry.
5.1.6 ISO 19115 metadata, C.A.R. profile.

It is the module that contains the maintenance of the metadata for the existing geographic information and the complementary tables of codes according to ISO 19115 regulation.
5.2 Web maps viewer. With free access for anonymous users.

It allows interactive consults, through internet, of all the cartography contained in ORACLE and also the other compatible OGC servers, with the following features:

- Hierarchical tree of the layers, organized by families, subfamilies and themes.
- Navigation functions and toolbars for the map.
- Active layer: information of the selected entity of the map and its data table.
- Legend of the obtained layers, with possibility of changing the viewing order and styles.
- Change of coordinate system of the map. Selectable by the user.
- Automatic maintenance of OGC-WMC services tables according to the coordinate system.
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Qualified in Business Sciences by the Zaragoza University (Spain) he works since 1983 in computer programming for the Spanish Nature Conservation Institute (ICONA).

In 1985 he begins to work for the “Government of La Rioja” with Geographic Information Systems software, coursing different studies about Computer Geographic Systems, Cadastral Cartography, Remote Sensing, Global Position Systems and Relational Database Management Systems.

Since 1996 he is responsibly for the Geographic Information System Section in the Government of La Rioja.

In these last years he has led the Corine Land Cover 2000 (UE Project) in La Rioja scope, and he usually takes part in the Work Groups of the Geomatic, Cartographic Norms and Remote Sensing Committees of the Spanish “Consejo Superior Geográfico”.

Currently he leads the IDERioja Project for the geographic data management in a corporate and administrative environment.

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Academic studies: Systems Technician by the Escuela de Informática of Deusto University, now named Facultad de Ingeniería ESIDE.

Professional experience: Since 1977 he has developed his activity as Programmer, Analyst, Consultant and Project leader in several companies, including computer manufacturers, consultancies and public administration. The following ones can be highlighted in chronological order:

CP Control Presupuestario S.A., presently Grupo CP, both in Bilbao and Barcelona.

Grupo GTEI (Gabinete Técnico de Estudios Informáticos), in Pamplona and Logroño.

SECOINSA, formerly belonging to INI, lately bought by Fujitsu, in Pamplona.

SAICAR (Sociedad Anónima Informática de la Comunidad Autónoma de La Rioja), in Logroño. It is in this civil service company where he has worked as a project leader, building and designing the IDERioja system.