CHILEAN GEO-SPATIAL NATIONAL DATA INFRASTRUCTURE (INDE)

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ABSTRACT

The present paper summarizes a joint effort undertaken by several Chilean institutions in order to develop a Geo-spatial National Data Infrastructure, which is conceived as a system for integrating not only geographic information but also covering the necessary administrative and legal regulations, technological and economic resources, data standards, and, of course, the means for the distribution and presentation of the national geo-spatial data.

With the conversion from traditional to digital mapping and with the development of Information Technologies, multiple needs have arisen for the increasing use of geo-spatial information in the majority of planning processes, especially those related to the development of the country. At the same time many small geographic or cartographic systems have been developed, mostly incompatible with each other. Regarding these matters the Chilean government has decided to begin implementing several initiatives related to the definition of a higher degree of coordination among those Chilean institutions that generate geospatial information and those which use it. At the same time the Chilean body responsible for producing the official cartography of Chile, the Military Geographic Institute, is implementing a Clearinghouse Web site which will be used to inform users of the available digital cartography of Chile and its pertinent Metadata. In this context several accomplishments related to the most important initiatives can be reported as already under way. The most interesting conclusion relates to the general interest in, participation in, and definition of general multi-user standards that would make it possible to integrate differing Geographic Information Systems.

INTRODUCTION

The term Geo-Spatial National Data Infrastructure (INDE in Spanish) arises from the first attempts to coordinate and exchange data between those bodies entrusted with the production of geographic information.

It owes its existence to the need to order and unify, at national level, the spatial data distributed around various public and private bodies, so that the interaction between data and access to it be fast and efficient.

The INDE groups together those systems, network connections, standards, elements and institutional resources involved in the provision and handling of geo-referenced information created by the various producing agencies to a wide group of potential users.

DEFINITIONS

National Spatial Data Infrastructure (INDE).

The INDE is defined as the set of technological tools, policies, standards and resources necessary for acquiring, processing, storing and improving the geospatial information that is distributed through efficient and rapid electronic network systems.

It covers :
- Data, which constitutes the raw material for the system and is made up of the geospatial information involved, either graphic or alphanumeric data.
- An Institutional Framework, that defines the policies and administrative agreements for creating, maintaining and gaining access to the data.

- Standards, for unifying the technical characteristics of the fundamental data and setting up exchange formats which support access to and transfer of the data.
- Electronic Network (Clearinghouse), which is the means by which the community in general gains access to the data, in accordance with the policies defined and the technical standards established, for the development of their applications and of new information.
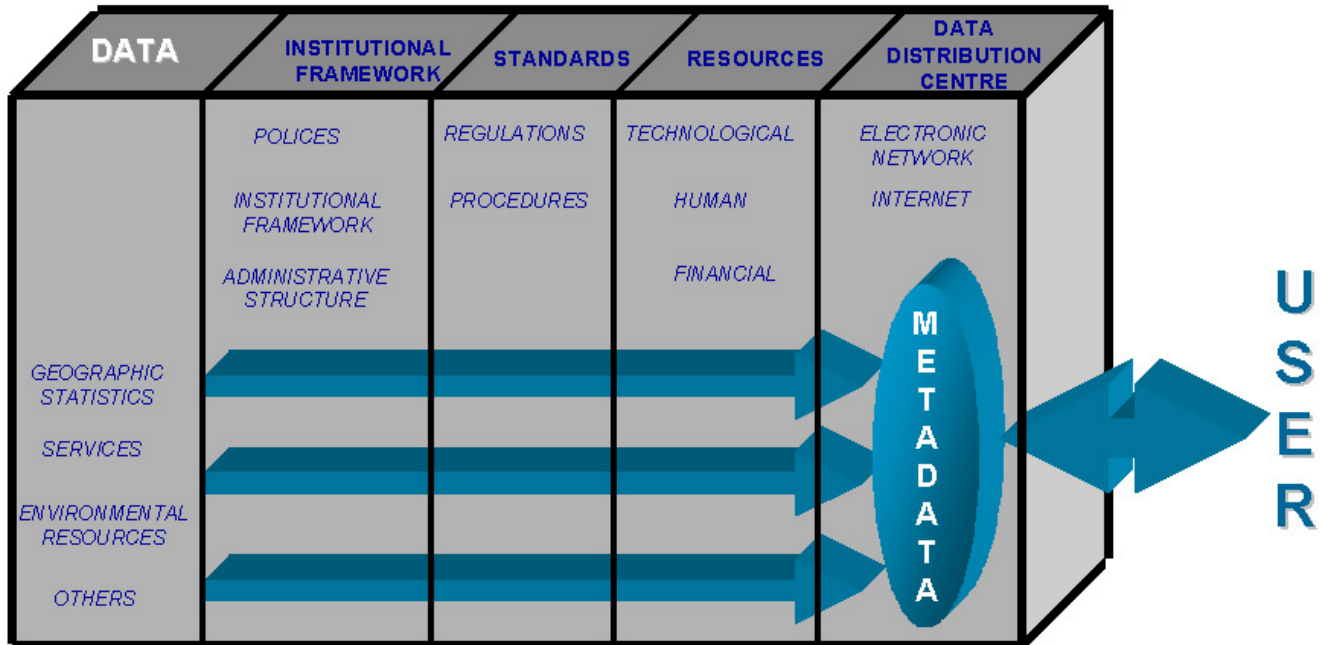

FIG. 1 : National Spatial Data Infrastructure

Clearinghouse

Also known as a Central Data Distributor, it can be described as a network for distributed information and electronically connected in order to provide acccess to the information. Its central trunk route is the Internet.

From an institutional viewpoint, it can be described as a "human and technical infrastructure resource which supports the finding of those who possess geographic information".
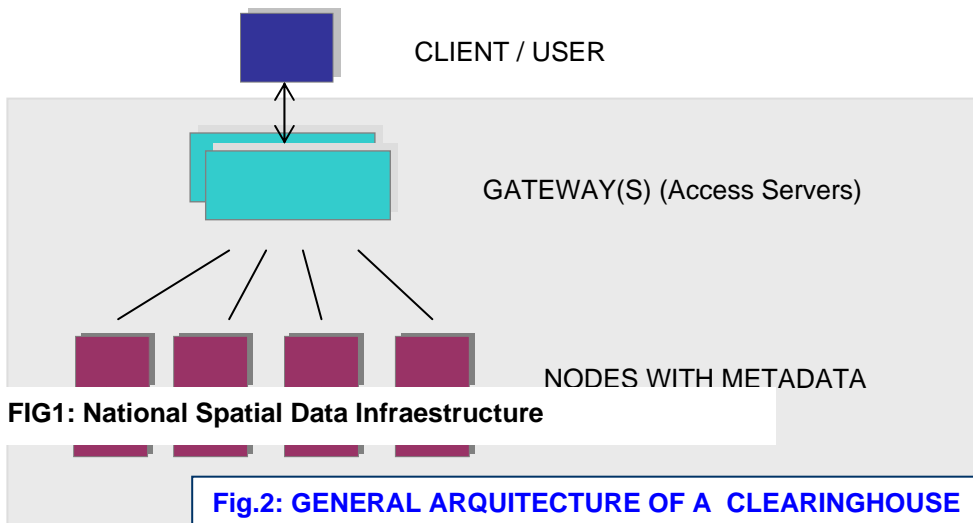

FIG1: National Spatial Data Infraestructure

Fig.2: GENERAL ARQUITECTURE OF A CLEARINGHOUSE

Metadata.

Description of the technical characteristics and properties of a geospatial file (data about data).
Eg. : The legend and marginal information of a map, this being metadata for the main body of the map.
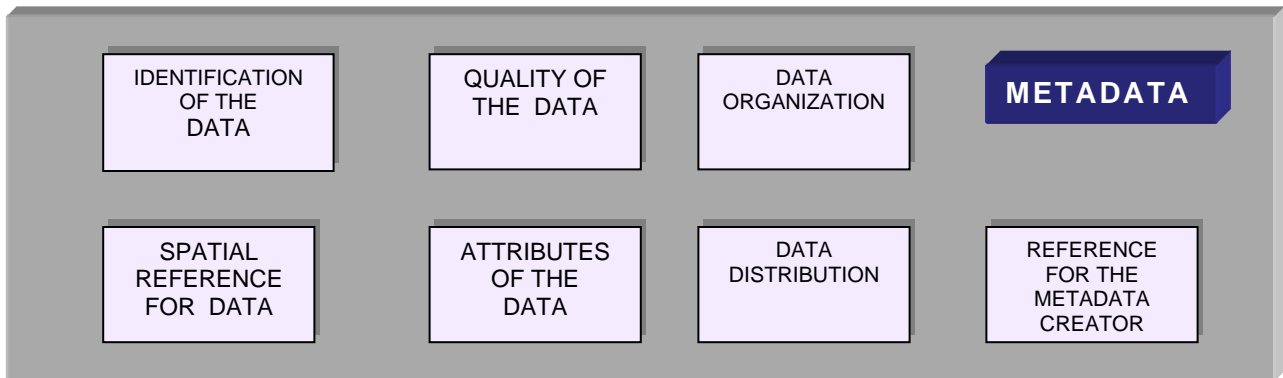
IDENTIFICATION OF THE DATA	QUALITY OF THE DATA	DATA ORGANIZATION	**METADATA**
SPATIAL REFERENCE FOR DATA	ATTRIBUTES OF THE DATA	DATA DISTRIBUTION	REFERENCE FOR THE METADATA CREATOR

FIG. 3 : Metadata Components

Data:

Digital file which describes an object.

Standards:

A set of terms and definitions for the integration of information from digital geospatial data.

Geographic Information Systems :

Systems made up of hardware, software and procedures designed for the capture, storage, handling, analysis and presentation of spatially georeferenced data for the solution of complex problems in specific areas.

Two data bases can be found in a G.I.S. : one for spatial data, the other for alphanumeric data, together with a database manager.

Territorial Information Systems

This system consists, on the one hand, of a data base containing information about spatially referenced terrain within a defined urban or local area, and on the other of procedures and techiques for the systematic gathering, updating, processing and distribution of the data. The basis of a T.I.S. is the provision of a consistent spatial reference system.

ANALYSIS IN CHILE

In this country there is a large quantity of information distributed across various Ministries, services, businesses, Institutes and others, which, faced with the need to interrelate amongst each other, are hindered by their use of differing digital information systems which lack a common geo-referenced framework and are not compatible with each other.

The various systems developed are subject to the need to manage and put in order large volumes of data, in order to optimize the management of specific sectors in their various fields of operation, and not to any general vision held within the company, Ministry, or other organisation. The above causes failures in communications and integration among the sectors involved and between them and the general social environment. This leads to

wasted effort and lost costs due to the failure to interrelate, take advantage of, and share the information produced by all of these substantial efforts.

We thus find that, for example :
- Systems developed by Municipal and Borough authorities satisfy the sector – by – sector needs of some of their individual departments and not the overall needs of the Departments which, as a whole, make up the system of Municipal management. This means that their internal interoperability and their relationships with other municipal systems do not exist.

- The systems of information developed by the various regional governmental authorities are evolving subject to the same conditions as mentioned for the Municipal systems.

- The situation of the Service organisations, despite possessing greater resources, is not substantially different from that of the previously-mentioned entities. They have developed Geographic Information Systems, with different Geodesic points of origin and different information formats. In the majority of these cases there is an unneccessary duplication of data.

- The business sector (forestry, agricultural, mining, etc.) is in a situation not substantially different from that of the governmental bodies. In their case, they have oriented their efforts and resources towards satisfying their own needs, which are obviously linked to their production areas, neglecting the need to interrelate their data with that of their peer companies. These businesses, as a result of their high level of competitiveness, do not try to standardize their systems nor to invest significant human and financial resources in the fulfilment of the needs for standardization, given that, operating in the private sector other factors such as efficiency and high production rates at the lowest possible costs take precedence.

It can be concluded on the basis of the above that there is no _National Standard_ for determining the policies that would support and help compatibility among, access to and use of geospatial data , which in turn means that neither are there the _Technical Standards_ for defining the charactersitics of the data. This means that currently spatial data follows no standards, and so it cannot be shared without a considerable additional effort being applied.

The _Human Resources_ needed for the management, development and analysis of these systems is minimal, and the available personnel lack sufficient knowledge and awareness of these systems.

Cartographic and Geodesic Bases, and Geographic Information Systems

The Military Geographic Institute of Chile is the official state body entrusted with the geographic representation of Chilean territory, which means that its work necessarily involves the handling and use of geo-spatial information. The geo-spatial information, through the use of the Base Cartographic and Geodesic datasets, constitutes the most fundamental and basic data for the "National Spatial Data Infrastructure" (INDE) and is thus able to satisfy the needs of users regarding specific geographic areas.

National Geodetic Network

The Chilean Geodetic Network, considering its planimetric function, is a homogeneous system covering the whole country. From Arica to Puerto Montt the standard Cartographic system is referred to PSAD56, and from Puerto Montt to Cape Horn it is referred to SAD69. Currently there is a project in progress for relating the whole network to the ITRF-2000 and WGS-84 Global System.

Regarding the altimetric network of Chile, this is structured at a nation-wide level with the presence of a network of Geodesic Altimetric Lines, located along the road system from Arica to Puerto Montt, excepting the Eleventh and Twelfth Regions where several series of points have been established in individual sectors along the roads in those local areas, this being necessary due to the difficult topographic conditions of these southern regions.

Given the urgent need to have available a suitable geospatial reference framework, current efforts are being centered on a study for a project to adapt the whole of the Chilean Geodesic Network to the WGS-84 Global

System, which would make it possible to relate and use all the existing points and have a modern and homogenous network for the whole of Chile.

Cartographic Base Datasets

Towards the end of the 1980's the Military Geographic Institute had to face new technological advances that were making a substantial impact in Chile. These advances were aimed particularly at the management of large volumes of data, with a high level of demand for information.

The territory of Chile was represented in physical space, that is, in a geo-referenced cartographic dataset, using a fixed format, '*on paper*'. It became necessary to manage this cartographic information more rapidly and efficiently, in other words it became necessary to handle the information using computers.

Faced with this situation, the process of obtaining digital cartographic information began, slowly and with difficulty. The digital cartography is essential for develeoping and applying Geographic Information Systems.

After detailed study and analysis of the systems available on the market and of the experience of other countries more advanced in these matters, a series of software programmes and hardware equipment was chosen for the production of digital cartography.

The production of digital cartography at the Military Geographic Institute was divided into two overall areas:

- Base Cartography in digital formats at various scales
- Large scale digital Cartography

Digital Cartography at various scales is aimed at the representation of Chilean territory at :
- 1:50,000 scale, along with the 1:100,000 scale for island regions
- 1:250,000 scale, and
- 1:500,000.

Base Cartography in Digital Form, remains within the same geodesic and cartographic reference systems inhabited by traditional non-digital cartography, and is structured in thematic files in accordance with the type of information contained. Thus a map can be made up of thirteen files at the most.

Large Scale Digital Cartography, has evolved as the experience of various users has become available as feedback. Initially the guiding concept was to structure the work by map sheets and, within these, by levels or layers. Currently the concept is to satisfy the needs of Geographic Information Systems, so the work is organized into thematic files and, within these, the information is structured by levels and clearly defined graphic elements (lines, points, polygons), so that the user can establish his applications and assignment of attributes on a foundation that is well defined cartographically and graphically.

Geographic Information Systems

The development of Geographic Information Systems began in Chile from the 1980's onwards, starting with some preliminary applications which, through foreign technology programs and the use of personal computers, speeded up and simplified some specific tasks. The forestry and mining sectors were the pioneers in this area, soon discovering that they could not achieve optimum results without a suitable geo-referenced base.

The introduction of these systems into the various areas of development in Chile has risen exponentially over recent years. Nevertheless, the greater part of these systems operate at a local level as a complex and costly system fulfilling the needs of individual sectors or areas in a company, government ministry, Municipal body, or one of many other bodies.

At a national level one of the most widespread software tools is the set of products of the American company ESRI, which has sold 1,650 licences for its ARCINFO and ARCVIEW products.

Knowledge of these complex systems is scarce at national level, the available expertise being aimed more at applications for individual sectors and uses. The software packages currently on the market are under-utilized, rarely being taken advantage of to an optimal extent.

 Actions Undertaken in Chile.

Following on from the "Analysis – In Chile", and due to the fact that it is one of the functions of the state to coordinate the management of territorial information necessary for the right development of the country, a work group was set up in the year 2000 with representation from the various sectors of activity in Chile with both producers and users of territorial information. This group has been under the general supervision of the Public Assets and Property Ministry, it is within the framework of the modernization policies of the State, and the impulse to create it has stemmed from the Presidential offices. The work group will first of all study the situation in Chile regarding IT and then present proposals for action aimed at ordering and organizing IT at a national level.

After almost a year of work, and the carrying out of seminars in which international and Chilean experts participated, it was concluded that there is an urgent need for a 'State Territorial Information Policy' with the objectives of : coordinating, updating, transferring and communicating the existing information, both that produced and that which will be produced in Chile, also providing standards and guidelines for that information and making it more systematic and internally compatible. This means the creation of a 'National Territorial Information System' to be backed by a legal, technical and institutional framework inspired by the principles of cooperation and multiple use of IT.
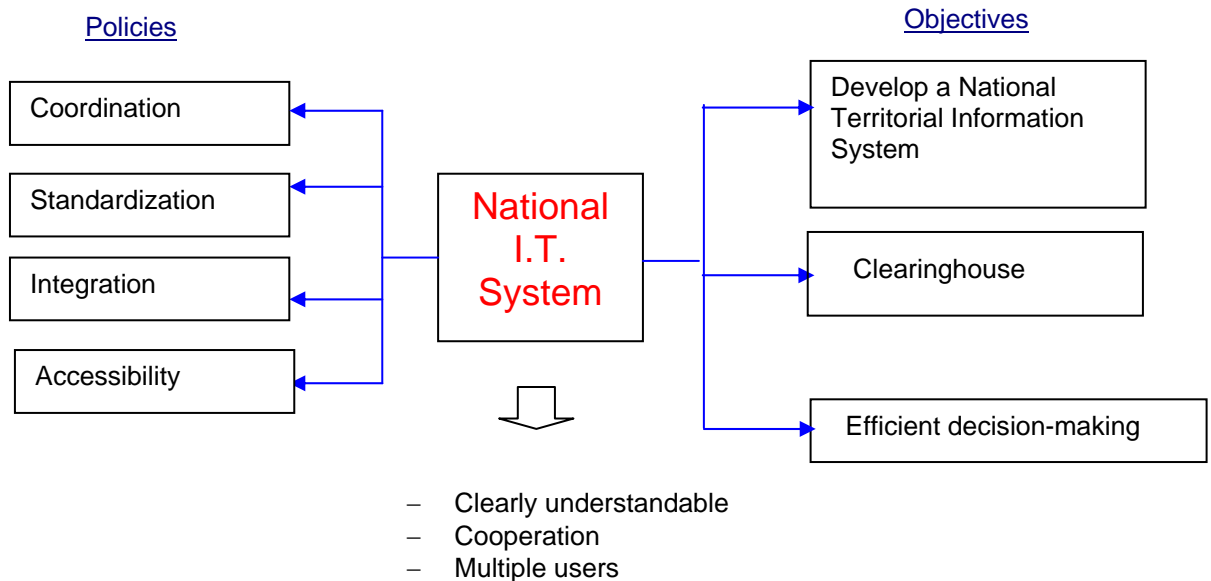
Policies

Objectives

Coordination

Standardization

Integration

Accessibility

National I.T. System

Develop a National Territorial Information System

Clearinghouse

Efficient decision-making

- Clearly understandable
- Cooperation
- Multiple users

FIG. 4 : National Terrorial Information System

The Territorial Information System should be a decentralized service, overseen directly by the Presidency of the Republic of Chile.

Moreover, within the work group led by the Public Assets & Property Ministry, four specialized sub-committees were set up to study in a more detailed and precise manner the following :

- Digital Cartography
- Provision of Standards for Territorial Information
- Policies for the financing and exchange of Territorial Information
- Design and Structuring of a Clearinghouse

FIG. 5: Military Geographic Institute of Chile, Clearinghouse Node

In parallel with the above, the Military Geographic Institute is concentrating efforts on the creation of a Clearinghouse node, where metadata will be available covering all the cartographic information it produces at different scales. At the moment this is in fact the IGM node, where metadata is available for the regular cartography at 1:250,000 and 1:500,000 scales, whilst the 1:50,000 scale cartography and the large scale digital cartography is currently being worked on for this.

CONCLUSIONS

As the Official body resposible for Geographic Information in Chile, the Military Geographic Institute of Chile has focussed one of its efforts on the developing of "Geo-Spatial National Data Infraestructure (INDE)". All of this under the framework of the modernizatrion policies of the State.