AGILE
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Hanasaari
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Helsinki/
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May 25-27
2000

3rd AGILE CONFERENCE ON GEOGRAPHIC INFORMATION SCIENCE

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Association of Geographic Information Laboratories in Europe

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A Web-based Geo-Data Server for Antarctic Data

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Abstract

The Italian Antarctic scientific community has produced and is producing sector data located in thematic centres specialised for discipline. The actual Information System, to manage and diffuse scientific data and information concerning the Italian Antarctic expeditions, is composed of a set of heterogeneous databases located in these thematic and distributed data centres [1]. The ESA-ESRIN centre contains the metadata, structured as a subset of CEOS IDN (DIF format). All the data centres and ESA-ESRIN are accessible via Internet.

Starting from this situation, we designed and implemented the South-Pole Directory, a multidisciplinary directory that provides the user with the research and available data description as well as the procedures for data releasing [2, 3]. The Directory adopted the Directory Interchange Format (DIF) of the National Space Science Data Centre (NSSCD).

During the last years the South-Pole Directory has been tested and improved in various parts. This testing and developing activities have evidenced additional needs the system itself should fully satisfy: a co-ordinated evolution of the various databases, in order to overcome problems such as different data models, poor integrability, lack of definition of standardised criteria and so on; a non proprietary use of the databases; an integration of meta-information; a good documentation of data; a consistency of interfacing among the various centres; a common model for accessing the different local databases; a good efficiency and capability of exploiting the research instruments and, finally, a knowledge of available data and of information about them.

Starting from these concepts, we began to design a new system, able to implement a Geo-Data Server for Antarctic Data [4, 5]. This new system has the following goals:

- To allow the multi-disciplinary analysis of the data collected within the Italian campaigns in Antarctica and of the subsequent elaboration carried out.
- To dispose of a consultation and help tool having a specific functionality for an integrated use of the data provided by the different research groups.
- To allow data integration on spatial basis.

The main advantages this system should achieve are:

- A scientific information rightly structured and standardised, because it could be diffused into various scientific contexts to produce synergy in the study of interdisciplinary problems.
- A strategic interest both in the valorisation of previous scientific experiences and in the aggregation of multiple specialist competencies.
- An harmonisation with the international context through the participation in international research activities.
- The capability, for a research sector having worked traditionally on its data, to access the data produced by other sectors in order to define an interdisciplinary research activity context.
- The implementation of a spatial-based integration of the consolidated data contained in the various data centres, giving an additional value to the current information power.

- The knowledge that some data exist and are available, together with their exact and detailed documentation, as a remarkable value, especially considering that data production is quite expensive.
- In a national context, the increase in value of the actual South-Pole System, being the information kernel of the current PNRA knowledge.
- In an international context, the strategic and relevant factor that PNRA can be connected to other countries by sharing research data and results (see Art III of the Antarctic Treaty and the several recommendations of SCAR on Antarctic data and information availability).
- The alignment and/or the adaptation to standards of data models resident into international databases to allow the PNRA information to be shared with international research groups, and vice versa.

Within this frame, our project points to obtain the following main objectives:

- The definition of a reference data-model usable and extensible for local GIS needs
- The activation of a network geographic data server based on existing network facilities (Internet)
- The organisation of an available data catalog with relative characteristics
- The adoption of a standard cartographic base (area of interest, scales, themes, ...)

The system thus should be able to provide [6, 7]:

- Remote access to all the information
- The possibility to perform comparative and interdisciplinary search
- Compatibility with international standards
- Efficient organisation of the data and the operational flows
- Homogeneous user-friendly interfaces

The data centres are data providers and users only. The data management, and their best organisation, is an exclusive task of the Geo-Data Server (GDS). What's stored in GDS are exclusively consolidated data that can be directly downloaded from the system without long and complex authorisation procedures. All data and their descriptions are stored in a unique centralised system, the GDS Archive; GDS provides a unique interface for searching and accessing all available data.

As already mentioned, to better manage the search operations, the GDS works on consolidated data only. These data are inserted in the internal GIS component after an integration phase consisting mainly of adopting:

- a common geographic reference system,
- a homogeneous data model,
- the definition of metadata and creation of a data catalog.

With these characteristics the data availability can be enquired on geographical area and on a predefined set of attributes. This operation can take advantage of the use of visual tools for geographical-like data or of a set of attributes thesauri. This provides the user with a better way to get the query that it has in mind.

The Geo-Data Server is made of two interacting parts:

- GIS-Host, for data processing and accessing
- Disco-Server, for metadata catalog management and classification and for discovery tools activation.

The Geo-Data Server has two different kinds of user functionality: the possibility to search the datasets within the catalog and the capability to perform complex queries. In any case, the Disco-Server component of the GDS performs the user-system interfacing. The user communicates with GDS by means of a Web engine, involving exclusively the Disco-Server without any initial contribution of the GIS and its database: in this sense, the metadata organisation can be optimised to obtain more efficient responses from the global system.

The GIS-Host component of GDS can perform a set of operations, like for instance the change of projection or the extraction from the dataset of a subset of data (in terms of geographic extension and

set of attributes). In any case, the GIS needs to receive a proper request from the Disco-Server, which is provided by a dedicated interface to get information directly from the GIS using DIF, as occurred in the South-Pole System.

The standards for geographic metadata we have been examined are:

- ISO/TC 211, the world standard
- CSDGM, the US metadata standard
- CEN/TC 287, the European standard
- DIF, a very simple US metadata standard

DIF is a very simple format to be implemented but it is too poor in information to meet our needs. The CSDGM, on the contrary, is very rich of information but it's too complicate to be implemented for the researchers. The better compromise is the ISO/TC 211 with the adding value of an international standard and the SCAR directive to adopt it. At present, this standard is still poor documented and we haven't found useful documents to adopt it. The CEN/TC 287 is a new European standard for geographic metadata. This, for its explicit declaration, will be similar to the ISO and more documentation is available; for this reason, we are implementing it in our GDS also as a concrete platform to migrate to the ISO/TC 211 when available. By analysing both these standards, we can see that DIF is completely contained in CEN/TC 287, except for disciplines. In this context, also the problem of field values conversion is under study, considering that some CEN/TC 287 fields are mandatory while in DIF they are optional or even not presents.

About Data Exchange Standards, we have analysed several international and national standards as well as proprietary (commercial) too. After a careful evaluation about the advantages and disadvantages of these alternatives, we have been oriented to choose initially the E00 and DXF+DBF proprietary standards, to solve the most part of users requests and to be operative immediately. This may be identified as a temporary solution waiting for the SCAR directives: the system in fact is open for adding all the needed data formats.

In conclusions, the adopted solutions to implement our GDS system for Antarctic Data are:

Standards:

- Metadata: CEN/TC 287 that will migrate to ISO/TC 211 (adopted by SCAR)
- Data exchange: several proprietary standards (initially E00, DXF); waiting for SCAR directives.

System Architecture:

- Two separate systems for Data and Metadata
- Scalable components configuration
- Use of commercial products (for hardware and software)

User Interface:

- Data query: graphical (geographical) and textual (alphanumerical)
- Data restitution: graphical (geographical) and textual (alphanumerical)

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