

CVRD Land Management Enterprise GIS

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Summary

Companhia Vale do Rio Doce (CVRD) is a leader diversified mining company of Americas and world biggest iron ore producer and supplier. Our core business includes logistic and eletric power. Concerned to bring value to its business processes begins to integrate geographic information existent in the company in order to develop a Land Management Enterprise GIS based on ESRI technology (ArcSDE, ArcIMS, ArcGIS). It intends to provide standards to geographic data, implement geographic database useful for all company units and objective assessment of interferences upon CVRD interest areas. Besides it intends to be a metadata server, allowing users to insert, update, delete and query any kind of data information existing in the company. This paper presents the System master management plan, logical, physical and data architecture.

Introduction

A key component to CVRD's business is the geographical location of the objects, facts and events related to the business process of the Company. In a number of circumstances, decision-making can strongly influenced aspects based on geographical location. In view of this fact, CVRD has made a number of investments to incorporate geoinformation technology into its processes and accomplish feasible and geographically consistent decisions, which are capable of bringing about risk and cost reduction in its production process. The following list shows a number of aspects that stress the importance of geographical location for CVRD's business:

- The territory where CVRD operates occupies a large geographical extension that is distributed in 13 states all over the Brazilian territory;
- Most CVRD's operations depend on the interrelation between different factors that are distributed throughout the geographical space;
- The development of the Company's operation implies a high degree of interaction with physical, biotical and socioeconomic media;
- The operations developed involve a high degree of complexity that is intensified by the geographical diversity of the territory;
- A large volume and a high diversity of geographical data are involved in the operations;
- There is a number of CVRD business units operating independently, and in some cases, in the same area of the Company's territory.

This System is the first corporate one based on geographical information and was designed by the Environmental and Territorial Management Department to provide CVRD with means that would support decision-making processes, so they can be conducted in an integrated fashion, based on full territory knowledge. Furthermore, this System was designed to fulfill a clear need to render available and share data (metadata) among the different business units of the Company.

System development process

To develop the System, CVRD hired a software developing company specialized in geotechnology. The adopted development methodology was the Rational Unified Process (RUP).

Its evolutionary aspect stands as a key advantage of the method employed. The idea was to develop a system by means of iterations (development cycles), where at each cycle a version of the system, which acquired new functions, would be produced and gain new functions (based on what was specified in the cases of system usage) and, if necessary, changes that would be proposed in the assessment made by users of former version of the iteration. This way, the system was built in a progressive fashion until it reached a version that would be capable of adequately fulfilling the requirements.

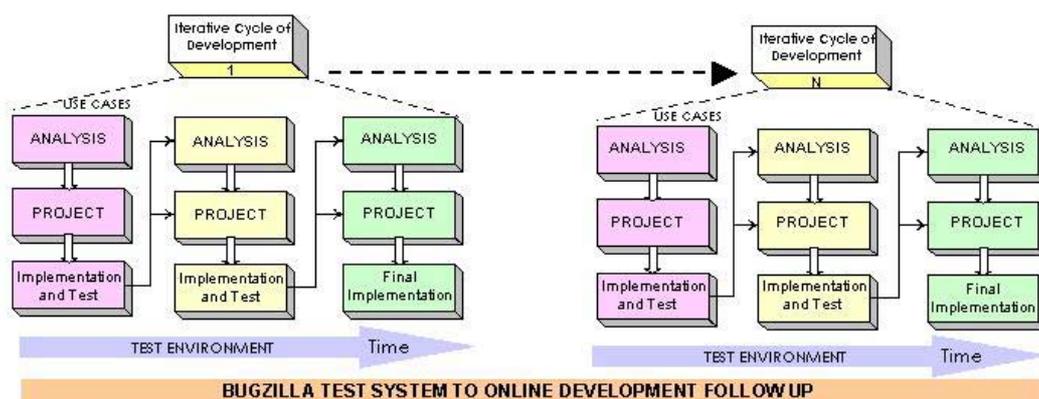


Figure 1 – Development Cycles.

Technology

The processes that make up the System will all be run on metaframe or intranet servers located at CVRD's IT data Center in Espírito Santo State. These servers should be accessed by all CVRD localities via metaframe tools or intranet accessing processes.

The metaframe based solution was adopted for applications dealing with geographical information. The metaframe solution proved to be effective because it had no effect on performance and preserved an adequate screen resolution that would allow the display of geographical information. For applications which referred to strategic reports, Intranet access mechanisms (browser) were adopted.

An additional advantage of using the metaframe solution, besides de link economy lies in the fact that a user workstation is capable of executing the customer's metaframe environment without any concern with specific requirements of the application software. These requirements should be met by the metaframe server where the application is actually being executed.

The System architecture is based on ESRI – ArcSDE, ArcIMS, ArcEditor, ArcView technology. The ORACLE technology is also a part of the solution. The implemented architecture physically consists of 5 (five) servers: 2 (two) of them with a Sun Solaris operating system; 2 (two) with a Microsoft Windows Server and 1 (one) Mainframe. The functional requirements identified during the System specification stage have been implemented with the software resources listed on the table below:

Requirement	Software
Spatial data Edition	ArcEditor
Inquiry creation and updating	ArcView
Spatial data manager	ArcSDE to Oracle
Web spatial data viewer	ArcIMS
SGBD	Oracle 8i (Solaris)
SGBD Client	Oracle Client 7
SGBD Metaframe Client	Oracle Client 8
Development Environment	J2EE
Web Development Environment	J2EE
Network Server	Novell
Operating system in the Network Workstation	Windows 95 / NT
Browser	Internet Explorer 5.5 and 6

Web Server	IIS
Metaframe Server	Citrix Metaframe 1.8 and Metaframe XP

Table 1 - Software for the CVRD Environment.

System architecture

The context of the CVRD Land Management Enterprise GIS comprises two major macro-functions. Management Module and Metadata Module – which meet the two main objectives to support strategic decisions involving the territory of CVRD operations and the availability of CVRD spatial data array.

The Management Module is divided into two parts: one in a *desktop* environment and the other in an intranet environment. The *desktop* part is made available to the user by means of an ArcEditor application, customized and remotely accessed from a Metaframe server (Farm Metaframevit). This application authenticates a user in the mainframe and refers to the authorization profile for access to its functionalities through the SEGUR application. The ArcEditor employs a *template* which requests the data needed for authentication at the mainframe, and after a user is authenticated, it checks whether or not the user can access that Module or functionality. Only then, the authenticated and authorized user may interact with the geographical data contained in information plans through the ArcSDE server, with other data in the data bank, and with ArcIMS to publish maps that may be accessed through the Intranet application.

The Metadata Module and the intranet part of the Management Module may be accessed by a user by means of a web browser which is capable of accessing a J2EE application published in an Oracle9iAS application server. Authentication (mainframe) and authorizations (SEGUR) are carried out, and the permitted functionalities are then made available. In this module, ArcIMS and Oracle9iAS application servers, both in PROD6, respond to requests. These application servers request data from ArcSDE and the data bank at PROD1, and in the case of ArcIMS, it also requests maps from the spatial ArcIMS ArcMap Server in CVRDAP8.

The Mainframe accounts for the central part of authentication via mainframe of System users in both Modules, while server PROD6 makes the SEGUR service available to define permissions. The Oracle8i data bank and the ArcSDE server are located at the Sun Solaris PROD1 server. This spatial and alphanumeric data base may be accessed by ArcIMS spatial servers (at PROD6 and CVRDAP8), through the Management

Module (in Farm Metaframe5) and also by the Metadata Module (Web), through Oracle9iAS at PROD6.

The following picture shows the System architecture.

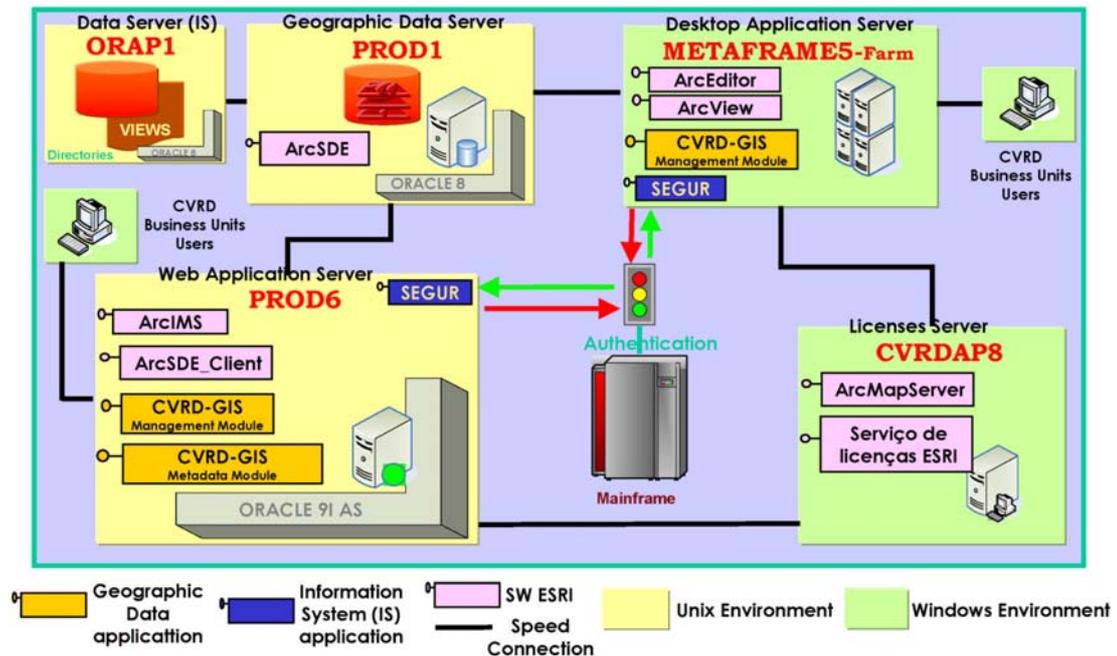


Figure 3 – System Architecture.

Functionalities

Management Module

The Management Module can be seen in three different interfaces. The first interface provides users with a complete set of spatial tools that allow the creation and publication of inquiries, an interface to edit the Information Plans contained in the central data base, and a WEB interface, which allows a prompt viewing of published inquiries.

Metadata Module

The Metadata Module may be accessed through an Indexed Map containing two interfaces. One allows simple inquiries to view the

metadata reference polygons, the other allows the array to be updated with the metadata editing resources.

The Figure below, depicts an overall view of the System.

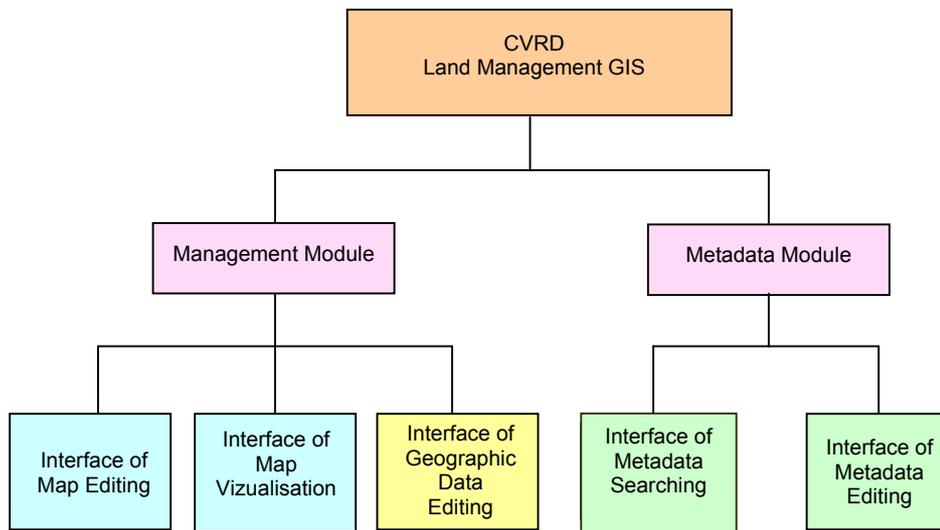


Figure 4: Overall View of the CVRD Land Management Enterprise GIS

Conclusion

The major benefits that should be expected by implementing the System are:

Providing the management with a strategic decision-making supporting System, which takes into account the dimension of the CVRD Territory and its areas of influence.

Integrating existing geographical information in the company, generating and maintaining a reliable data base that is capable of meeting routine CVRD needs.

Disseminating the use of geoinformation technology as a supporting resource to other operating units.

Optimizing the acquisition process of new data bases to fulfill the needs of the company in a shared fashion.

Optimizing the use of technological resources, avoiding the costs incurred in buying loose software and hardware.

After the System has been implemented, the incorporation of geographical dimension in the CVRD decision-making process begins. The geographical viewing resource should help the company to "see" the interrelations among objects, facts and events of interest, and thus act with the intention of minimizing risks and maximizing the company's operating results.

One of the goals of this movement for technological change is to ensure that the data infrastructure that supports the decision-making process be "*geographically conscious*", that is, be provided with the geographical dimension that is an inherent part of the Company's business. The idea is to walk the path that should make the Company step forward from geographically certified **operations** to a geographically certified **company**.

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