Report: Earth Data Namibia - a milestone in information management at the Geological Survey of Namibia: background, data base design, features, further planning

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Earth Data Namibia (EDN) is a customized software, managing geological and related data held by the Geological Survey of Namibia (GSN). It is designed as a client-server-solution within the local area network of the GSN, both for internal use and as a tool to provide open-file mineral exploration data to the public. At present Earth Data Namibia contains spatial and factual data on mineral deposits and occurrences, exploration and mining licences, geological reports, maps and other printed material, as well as related topographic and topocadastral information (e.g. farms, roads), together with metadata of scanned archival documents. To store and manage this factual, geometrical and unstructured information EDN uses powerful software such as ORACLE, ARCVIEW and WINDOWS2000. It forms part of the GSN's strategy to standardize the process of data collection - mainly from exploration licence holders, but also from other sources (e.g. own and university research) - and to facilitate easy accessibility and recovery of information related to the natural resources of the country. The system design allows its future growth and the addition of other modules, such as a literature and borehole data base.

Background and problems to be addressed

Being one of the best-explored countries on the African continent, Namibia looks back over a history of more than one hundred years of mineral investigation and geological research. Billions of dollars were spent by mining companies and the state on geological invest-tigations to utilise the natural resources of the country, the results of which are contained in thousands of files, maps and reports housed by the GSN archive in Windhoek. Previously these unique and mostly irreplaceable documents were available to the public and GSN staff directly, but deterioration of the partly very old material made its conversion into digital format desirable. Accordingly, over the past years various single IT-solutions were initiated at the GSN in order to manage the fast growing amount of information supplied by the exploration companies and improve its accessibility to potential mineral investors and other interested parties, which, however, tended to create fresh problems for both the user (where are the data?) and the system administrator (which data have to be stored?).

To resolve this undesirable situation a uniform information system that contains all the available mineral economic information was conceived as a first step, but with a view to gradually include other geoscientific data held by the GSN, such as bore hole logs and geochemical assays. This was all the more needed because of the enormous increase of redundant data stored in various data bases, as well as the introduction of competing soft-ware solutions and incompatible data formats. During the initial conceptual planning the following main problems to be addressed were identified:

- Increase the accessibility of archival exploration and other geological data by the public
- Prevent loss and destruction of unique documents
- Prevent the development and growth of redundant data
- Initiate a uniform information system at the GSN
- Introduce a long term IT-solution open to future growth and expansion

Data base design

The core of the data structure of EDN was designed as a relational database with a network of entities (Figure 1) that manages factual information and metadata about exploration/mining licences, mineral deposit/occurrences, company reports and other documents, as well as user rights and look-up tables. The spatial data (e.g. mineral licence areas, farms, roads) and scanned archival documents managed by the operating system are linked to the relational data base as shown in Figure 2.

Due to the large amount of data (several millions of records), the complicated structure of access rights, the number of users and the necessity to guarantee data security, a powerful software tool was needed for the

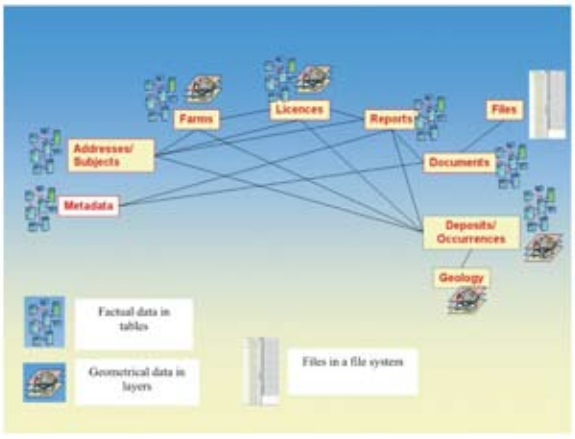

Figure 1: Principal structure of the relational data base

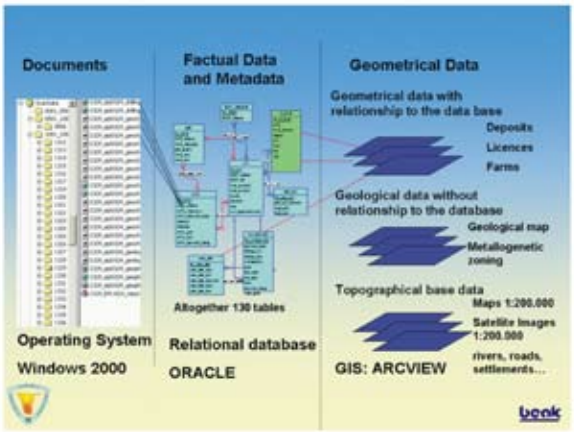

Figure 2: Relationship between factual data, spatial data and data files

data storage and retrieval system. In an initial development phase MICROSOFT ACCESS was used as a platform for the relational data base management system, but before long it became evident that the application could not efficiently handle the complexity of the data structure and was replaced with ORACLE. To manage the spatial data ARCVIEW 3.2 was chosen, because of its widespread use both within the GSN and among the targeted public. Three groups of spatial data are differentiated within the system:

- Vector data linked to the relational data base (e.g. farms, mineral licences, mineral deposits/occurrences)
- Vector data without linkage to the relational data base (e.g. geology, rivers, roads)
- Raster data (1:250 000 topographic maps and satellite images)

System architecture and structure of the Graphical User Interface (GUI)

The application was created as a typical client-server-software on the basis of the WINDOWS 2000 operating system; VISUAL BASIC 6.0 (for the data base part) and AVENUE (for the GIS component) were used to program the various GUI. Two different ver-sions of the application were designed, allowing full ac-cess to all data for the purpose of data entry, and with read-only rights for the distribution of the stored data to the public, respectively (Figure 3). This system is now fully operational within the local area network of the GSN and the Ministry of Mines and Energy.

The software was developed to be user friendly and largely self-explanatory (Figure 4) and includes an online help. The user logs onto the system via a start form, which provides them with a choice of various modules (e.g. farm module, licence module) to construct a query for information. Through the main document module exploration reports and maps, as well as other scanned data, can be called up and viewed on the screen, and/or printed out if desired (Figure 4). The GIS – component, which was built on in a second step of data base development, is entirely integrated with the application and can be activated directly from the start form or from each of the various modules.

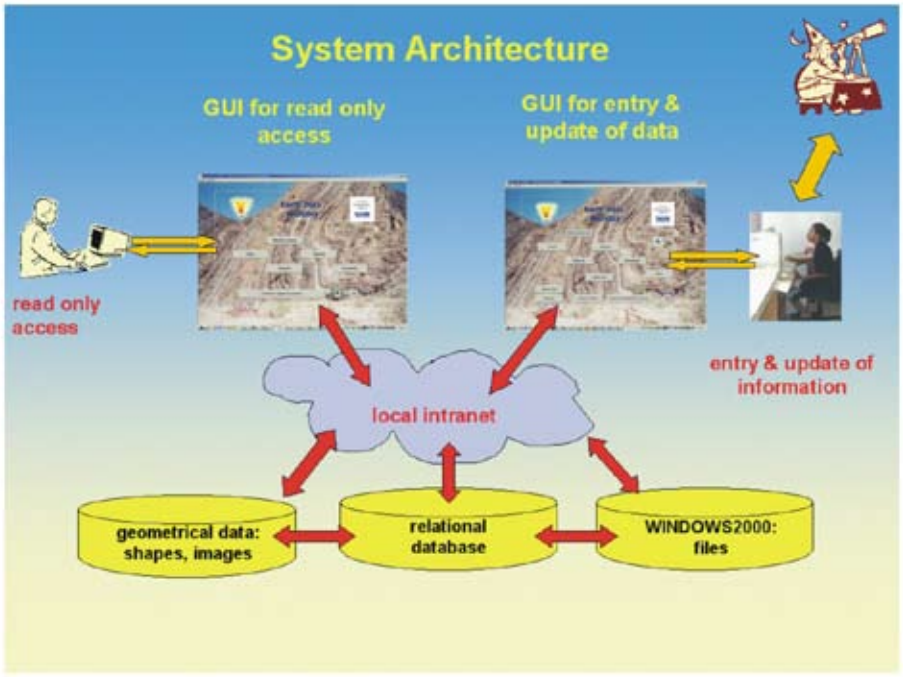

Figure 3: System architecture

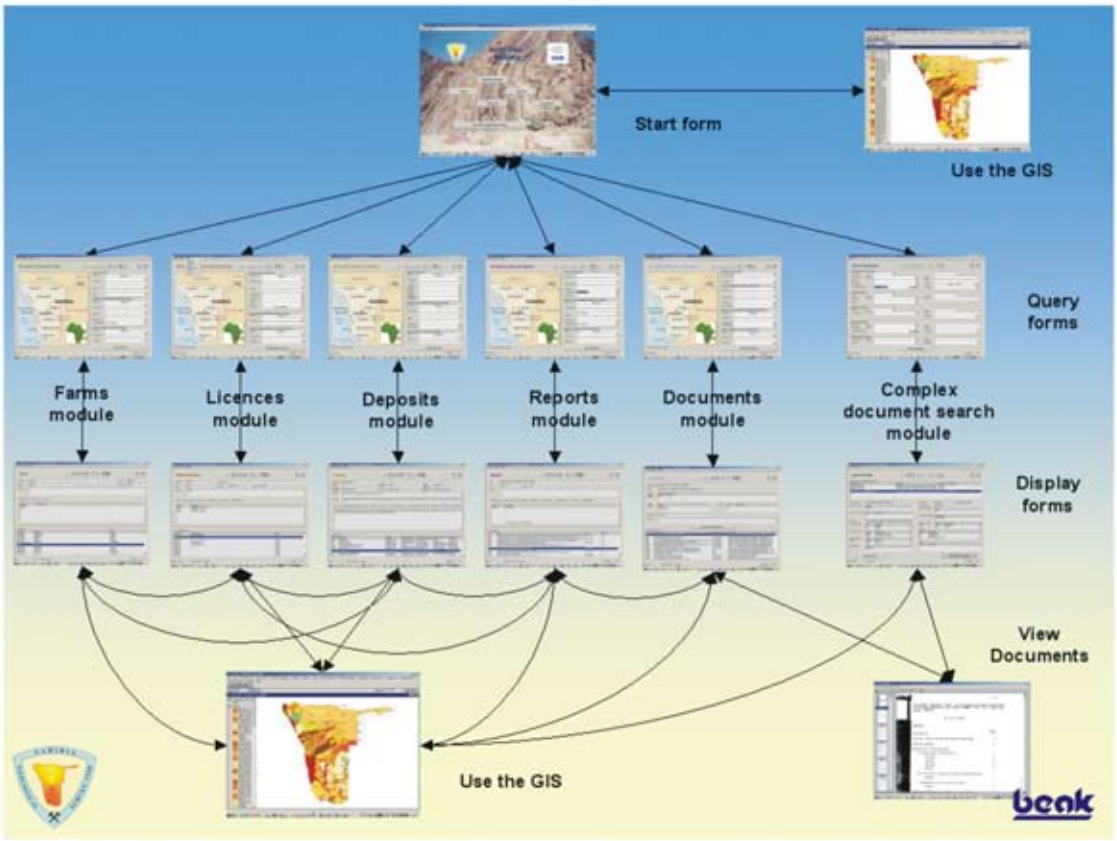

Figure 4: Principal structure of the graphical user interface (client version)

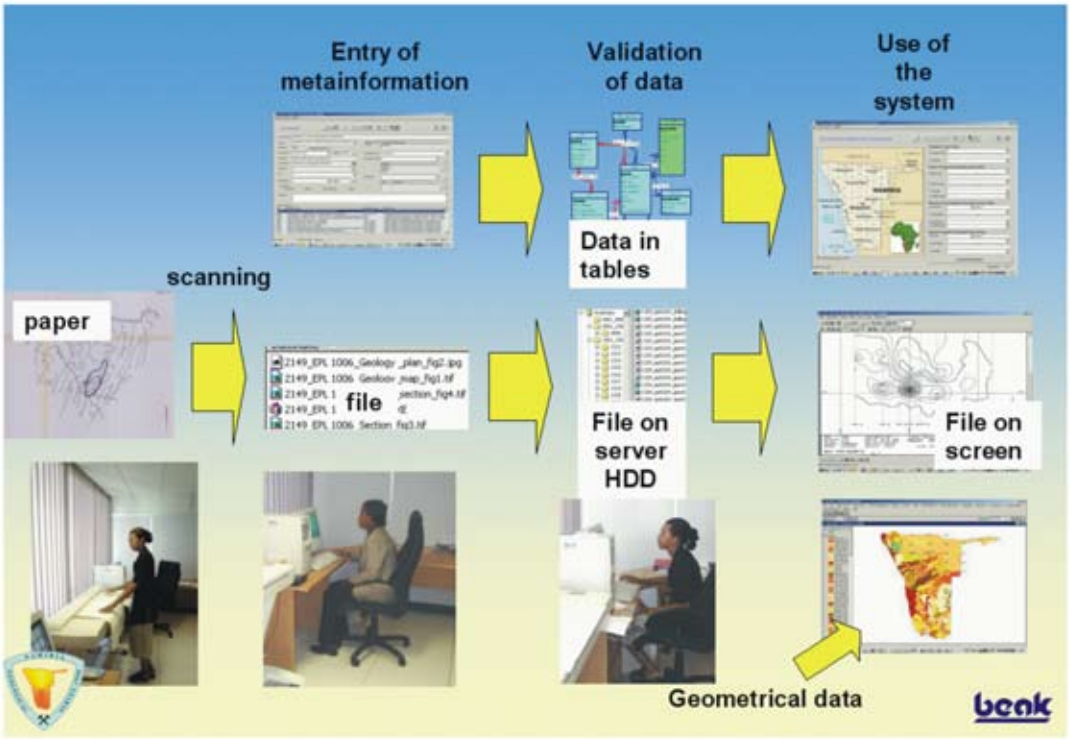

Figure 5: Data acquisition process for documents

Data acquisition process

The process of data acquisition for documents, such as exploration reports and maps, is shown in Figure 5. The EDN software supports the entire process of document scanning, entry and validation of metadata, as well as storage and maintenance of the data in a file system. At the time of publication digital capture of archival information is still in progress; after its completion new incoming data will be added to the system as soon as they become available.

Further Planning

The open and network-like design of the system allows a step-by-step development of the data model as well as of the software application (Figure 6). In view of the ever-increasing amount of information related to various aspects of earth science, an expansion of the cur-rent data structure is envisaged for the near future, and will be realized as funds become available. Planned data base extensions are concerned with information on:

- Mines and exploitation activities
- Drill hole data and analysis
- Environmental geology
- Geochemistry
- Geoscientific literature

Apart from including software to facilitate for instance the presentation of drill core sections and geochemical plots, it is furthermore planned to develop functions, which will allow the customized compilation of thematic maps and data by the user.

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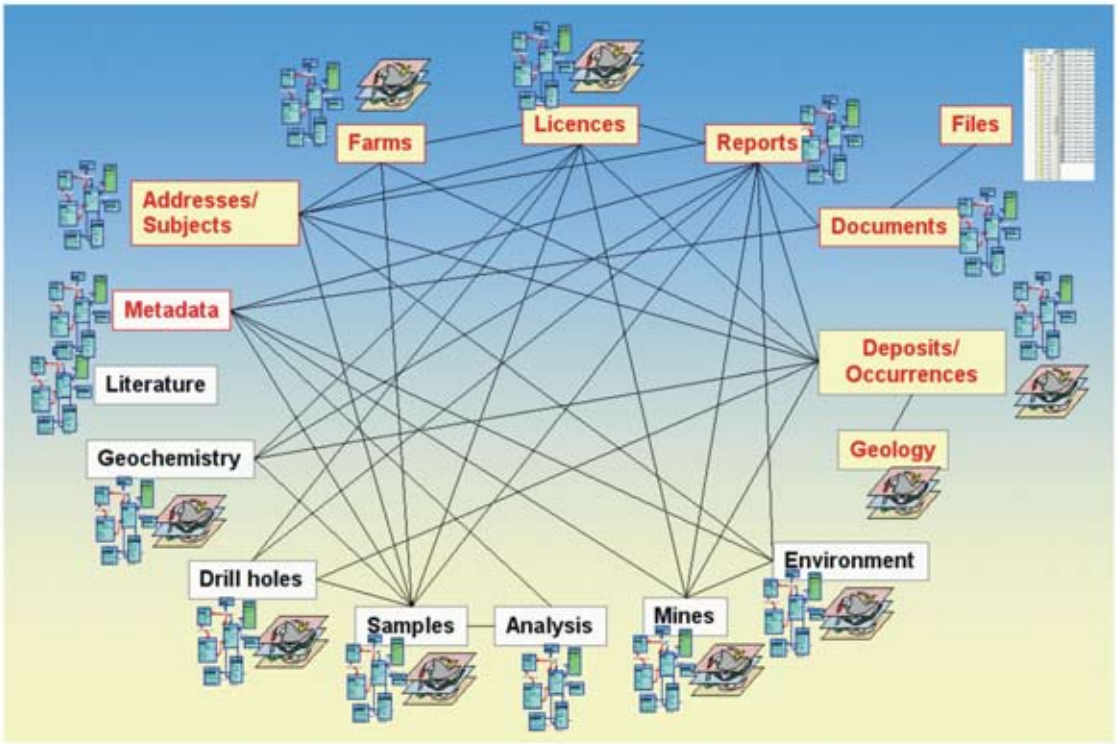

Figure 6: Vision of a future data model