EkoInfoNet
Information System for State Monitoring of Environment in Poland

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ABSTRACT

INTRODUCTION:

Polish Chief Inspectorate of Environmental Protection (CIEP) decided to run a high priority project aimed to create within approximately 3 years a modern information system for the State Monitoring of Environment. The first important reason is to provide decisional centres responsible for creation and implementing of ecological policy, local authorities and the public with credible and comparable information on the state of environment and on the processes occurring in it. The second one is to fulfil the requirements stated by the new Polish environmental code entered into force in January 2001. This code fully implements obligations of Poland as the signatory of the Aarhus Convention. The third reason is to fulfil obligations of Poland with respect to European Environment Agency (EEA). One of these obligations results from accession of Poland to the European Information and Observation Network (EIONET) a functional structure created to facilitate data acquisition on the country level. The conceptualisation of the system named EkoInfoNet was entrusted to the Institute of Environmental Engineering of Warsaw University of Technology.

1. GENERAL CONCEPTION OF THE SYSTEM

Conceptualisation of SME-IS (Fig. 1) encompassed overall issues starting from making measurements up to the use of information derived from these data.

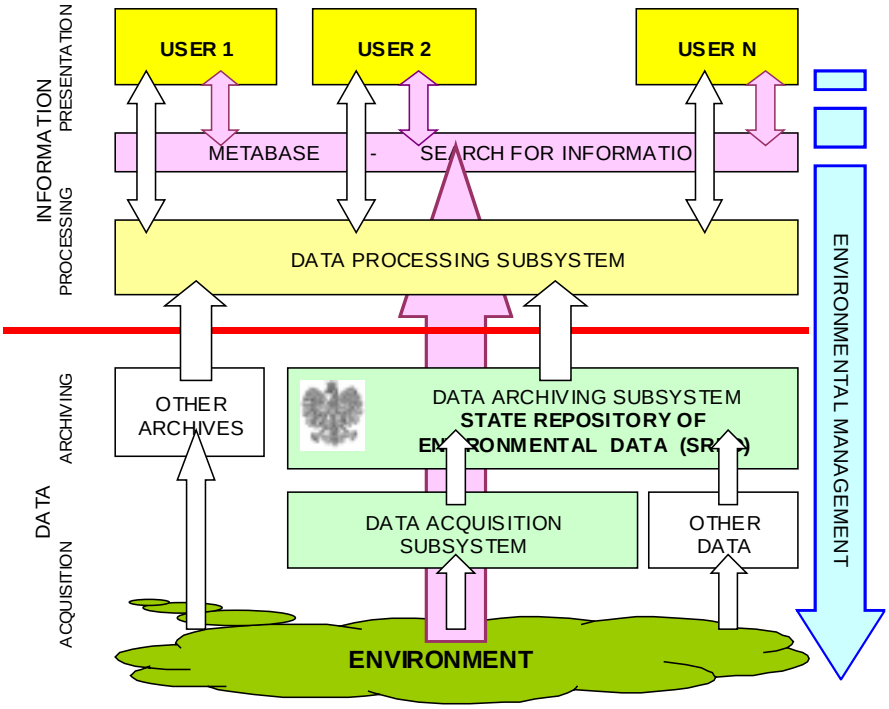

Figure 1. General conception of the system

The system will be composed of four subsystems: data acquisition, data archiving, information processing and information presentation. The last two subsystems will be logically and physically separated from the data acquisition and storing.

2. DATA ACQUISITION SUBSYSTEM

Environmental data in Poland are collected on the regional level in 16 Voivodship Inspectorates of Environmental Protection (VIEP) operating 23 local branches and laboratories. In addition some measurements and observations are entrusted to research institutes and universities. This creates highly distributed organisation of the State Monitoring of Environment supervised by CIEP who establishes measurement programmes and together with voivodship authorities is the main user of environmental information.

Schematic organisation of the data acquisition subsystem is presented on Fig. 2. The data come from three main sources: from automatic measurement stations (AMS) measuring air and some water quality constituents, from manual sampling processed by the laboratories, and from observation results available in the form of paper documents. All data are subject to initial verification made by the staff of State Monitoring of Environment or cooperating research institutes before they are transferred to VIEP source database.

An application DB_Transfer was designed to enable the transfer from the data collecting sites to VIEP. It has been assumed that all the data transfer will be accomplished by means of the teleinformatic network. Therefore, a thorough evaluation of existing connectivity between the elements of the system has been done and the plan of necessary upgrades has been presented as an element of the project. However, in rare cases one directional data transfer will be possible by means of floppy disks.

On the voivodship level the data are the subject to the secondary verification made by the regional database administrator. Source databases are organised separately for each of the environment's components, and correspond to the databases belonging to the collections described in the next section. To accomplish the final verification the database administrator is suited with an intelligent application assisting him to carry out a comparative analysis using graphic interface and statistical tools. Some artificial intelligence based methods together with mathematical modelling will be tested in order to provide an expertise in final verification of the data before qualifying it to the target databases.

3. DATA ARCHIVING SUBSYSTEM

Conceptualisation of EkoInfoNet started from the cataloguing of the actually available resources of the State Monitoring of Environment. This inventory provided the designers with the information on the measurement methods, sites and elements, actual data transmission methods, verification procedures and ways of storing the results. It was evident, that the database technology actually in use will not allow to create an information system and safe data archives. It has been decided by CIEP, that all the databases actually used to store the results of measurements and observations must be redesigned and reprogrammed using new DBMS. This strategic decision facilitated system design and organisation of data archives.

A key concept was to create a uniform archive based on a common, centrally maintained set of corporate data. The archive would constitute the State Repository of Environmental Data (SRED) – the entity established by the law and perceived as a source of relevant information of decent quality guaranteed by the state. The databases constituting SRED would belong to three collections as shown in the Table 1. In addition, a collection of

auxiliary data will be created in order to facilitate future interpretation of measurement results.

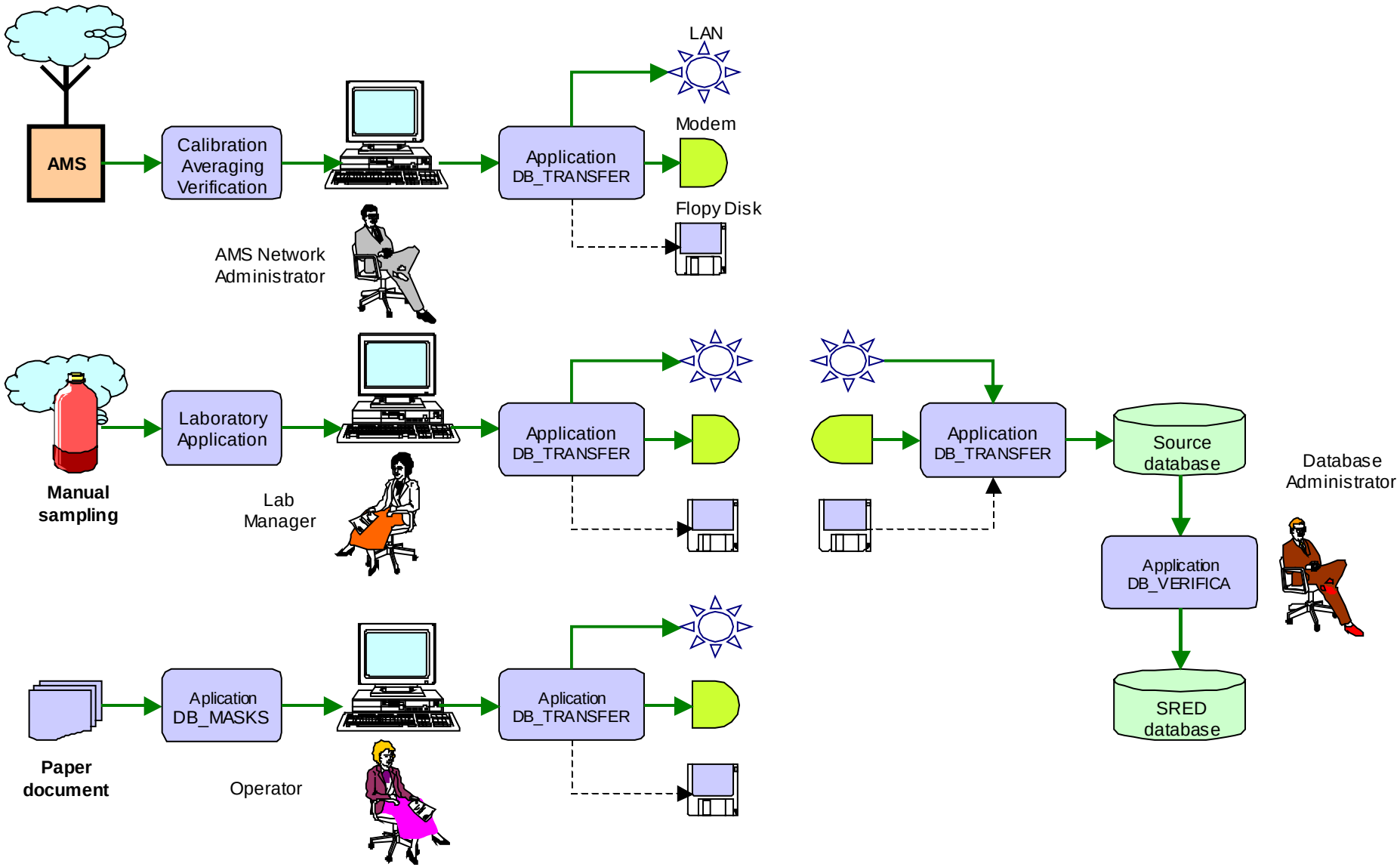

Figure 2. Organisation of the data acquisition subsystem

Table 1. Databases of the information system EKOINFONET

Corporate Data Databases			
Vocabularies, Institutions, Users, Authorisation data, Measurement Programmes, etc.			
Collection „Environmental Quality Databases”			
Name	***Component monitored***	***Name***	***Component monitored***
JPOAT	air quality	JHKOM	transportation noise
JCHOP	precipitation chemistry	JHIND	industrial noise
JWRZK	river water quality	JPROJ	ionising radiation
JWJEZ	lake water quality	JPRON	non-ionising radiation
JWZBZ	reservoir water quality	JLASY	forests
JWBAL	water quality in Baltic	JZMSP	natural environment
JWPOD	groundwater quality	JPRZY	selected ecosystems
JGLEB	soil quality		
Collection „Emission Databases”			
EPOAT	emissions to the air	EWRZK	point and distributed loads to surface waters
EODPN	solid wastes		
Collection „Incidental Data Databases”			
INZAS	Industrial/transportation accidents, hazardous materials, etc...		
Collection „Auxiliary Databases”			
Hydro/Meteo, Forests, Agriculture, Settlement, Geographical Information Systems data			

Conception of the databases architecture comprised the following:

- assigning elements of data and information collected in SME system to respective databases, where it will be stored,
- determining whether databases will have centralised or distributed architecture,
- selection of the databases locations,
- determining of the requirements reg. database management software, operating system platforms and servers,
- defining the general structure of the databases.

Measurement programs, measurement network topologies and measurement methods are subject to continue changes. This requires designing of sufficiently flexible data structures well able to adopt forthcoming changes.

The unique database that will have fully distributed architecture is the database JPOAT storing air quality monitoring results. This database has been designed, implemented and actually is under testing. The architecture of this database is presented on Fig.3. Sources of data are: networks of AMS operated by the State Monitoring of Environment, AMS operated by local (e.g. municipal) authorities and the industry, results from the manual sampling done by the State Sanitary Inspection. After verification done by the regional administrator as described in sec. 2 the data are stored in the regional database. On this level some regional applications will make use of this data. Among others, an On-Line AQ Monitoring application will be used for air pollution warning system to be established in special zones.

The data will be transferred to the central database situated in the central computing site (CCS) where will be used for central applications, such as large scale math modelling, reporting and presentation on web site.

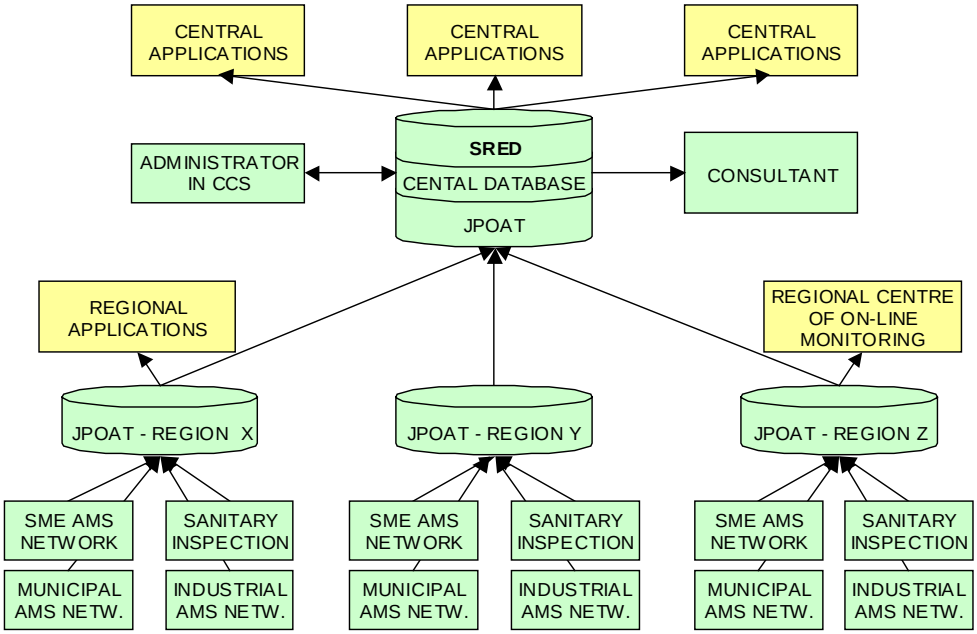

Figure 3. Air quality monitoring database JPOAT

4. INFORMATION PROCESSING AND PRESENTATION SUBSYSTEMS

Works on this subsystem started from the description of EkoInfoNet users and their requirements. The users have been classified in two basic groups: the end users and the data processing users. First group will be mainly interested in accessing the information on the state of environment in the form of plots, graphs and thematic maps. The second group will be interested in accessing to the data archives and elaborate them. This analysis led to the conviction that the basic modes of access to the information will be the WWW site and the reporting system. The conception of data processing and presentation subsystem is schematically presented on Fig. 4.

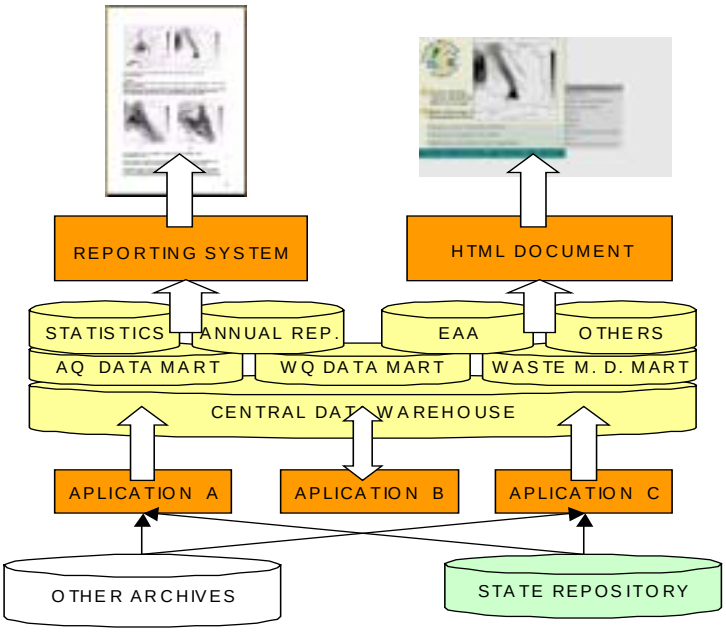

Figure 4. The conception of data processing and presentation subsystem.

Data processing will depend on the environmental component and will be comprised of an open-ended set of applications such as mathematical models, statistical and interpolation tools and many others. A data warehouse divided by thematic and functional data marts has been conceptualised to facilitate use of these applications.

Information produced in EkoInfoNet is mainly geographically oriented. Therefore it has been designed a massive use of Geographic Information System tools.

A concept of intelligent interface enabling a dialog of a user with the system has been also presented. The use of the meta-base suited with standard vocabularies will facilitate the dialog allowing the system to recognise user's interests and guide him through available sources of information. Such facility requires an application of artificial intelligence (AI) methods with particular attention given to the expert systems (ES) and artificial neural networks (ANN).

Public administration in Poland and the European Union institutions will need information on the state of environment in Poland in most cases in the form of reports. The reporting system will be worked-out facilitating and speeding-up creation of necessary reports containing up-to-date information from the system.

The project ended with detailed design of the web site including the concept of the web page graphics proposed by a computer graphic artist. Implementation of the web site will be the next task in the course of implementation of EkoInfoNet.