

A Technique Prototype Of Nsii In China: The National Spatial Information Network System

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ABSTRACT National Spatial Information Network System is the key technology of the NSII (National Information Infrastructure) construction. Through the National Spatial Information Network System, all levels of information sharing such as spatial information query, spatial data transfer and spatial decision support can be implemented. Based on the researches on the technologies of the spatial data standard, spatial database, network structure and so on, the analysis, design and implementation of the National Spatial Information Network System's function and structure have been presented.

1. Introduction

National Spatial Information Infrastructure (NSII) is the important component of the National Information Infrastructure (NII). NSII must include: National Public Spatial Information Communication Network, National Public Spatial Information Resource Network, Public Spatial Data Warehouse, spatial information management regulations and standards, framework and user system of national spatial information. The core is National Public Spatial Information Resource Network, the leading factor is multiple network management hierarchy and the user system, and the technique environment that support the implementation of NSII is the National Public Spatial Information Communication Network and the spatial information regulations, standards. National Spatial Information Network System generally includes the four basic components of NSII above-mentioned. In National Spatial Information Network System, the functions and correlation of these four basic components are distributed correctly according to the general program of NSII.

The National Spatial Information Network System is a distributed, electronically connected network of geospatial data providers, managers, data integrators, information analyzer and users. It is not a central repository where data sets are stored and managed. It can be used to distribute,

access, browse and obtain the spatial data sets. It also can be used to implement some certain spatial analysis and model analysis. National Spatial Information Network System is analysis, designed and implemented as the technical prototype and integration system of NSII. Through it, following functions can be implemented:

1. The spatial databases of each data provider that satisfy the standard protocol can be linked in and accessed as a node of the National Spatial Information Network System.
2. Users can access the National Spatial Information Network System and obtain the usability, applicability and obtain method about the certain data by varied ways. Users can also browse the certain data through the common internet explorer.
3. The heterogeneity and isomorous data from different sources can be transferred without semantic loss.
4. Information from the heterogeneity and isomorous data from different sources can be extracted and amalgamated so that the spatial query, analysis and decision-making analysis to mass storage, multiple datasets can be implemented.

With the high-speed development of information techniques, the need to spatial data are increased in many branches of the government and economic

fields. The meanings of the National Spatial Information Network System are:

1. It can reduce the duplicate produce of the spatial data, and strength the communication and cooperation among the data producers, managers and users.
2. It can satisfy the needs of the branches of the government and economic fields to access and obtain the certain spatial information conveniently.
3. It can implement the transfer, information extraction and amalgamation of the heterogeneity and isomerous data from different sources so that the national macro decision-making can be supported.
4. It can advance the information sharing and satisfy the needs of national information development as the key component and the uphold flat of NSII.

National Spatial Information Network System implements the information sharing on two levels: (1) Sharing of the spatial datasets. (2) Sharing of the spatial information. The former is implemented by distributing the spatial datasets and related spatial metadata on Internet so that the users can access, browse and obtain the spatial data. The system is a distributed network system on this level. The latter is implemented by extracting and amalgamating the information from related spatial databases to construct a central spatial data warehouse. It can satisfy the needs of spatial analysis and model analysis to certain users.

The managers of National Spatial Information Network System refer to the persons or organizations who maintain the system. The data providers refer to the spatial data producer or owner who satisfy the certain protocol of the system, they link in the system as a node to distribute their spatial data. The users refer to the persons who access the system to obtain their needed spatial datasets or information. The data integrators refer to the persons or organizations who extract and amalgamate the information from related spatial databases to construct a central data warehouse. The data analyzers refer to the users who have the authority to access the spatial data warehouse to make some spatial analysis and model analysis.

2. System Analysis

In order to implement the sharing of spatial data sets and spatial information on two levels, the system has following functions:

1. The system adopts Internet to link nodes. All distributed nodes have identical architecture, and can produce, manage, maintain their spatial databases and related spatial

metadata.

2. Spatial metadata editor has friendly user interface, observes spatial metadata standards. The metadata files can be archived in multiple file formats such as TXT, HTML, SGML.
3. All distributed nodes are compliant with Z39.50 protocol, satisfy the users' demand of accessing spatial metadata databases in the whole-distributed network system. The system employ an open systems architecture to the maximum extent possible.
4. The system has friendly metadata querying interface, supporting query based on time, location, title, keyword or other elements or union query. The query interface supports the common internet browsers.
5. The metadata management subsystem of this system has the functions to start, stop, configure the Z39.50 services, and can add, link and managing nodes easily.
6. The system has the function to browse the spatial data. When users discover the certain spatial data, they can use the WebGIS service to browse the data.
7. The system provides multiple data retrieving modes. When users discover the certain spatial data, they can choose data obtain methods that the system provided.
8. The system provides the spatial data transfer function to satisfy the users' need. The spatial data transfer module is developed according to the spatial data transfer standard so that the transfer can be implemented without semantic loss.
9. The NREDIS spatial data warehouse has the function to extract and amalgamate the information from related spatial databases according to the program of NREDIS integration. It can satisfy the needs of spatial analysis and model analysis to certain users.

3. System Architecture

3.1. General System Architecture

National Spatial Information Network System is a distributed network system including many nodes such as the Ministry of Water Resource, the Ministry of Forestry, China Academy of Science, the bureau of Marine Resource, the Ministry of Geological Minerals, the Center of Basic Geographic Information of the Bureau of Survey and the National Spatial Information Clearinghouse. Each node has the same architecture and functions and is maintained by data providers. The diagram given in Figure 1 illustrates the overall architecture

of National Spatial Information Network System. The backbone of the system is the ministries and commissions high-speed data network and Internet. The nodes that above-mentioned are linked into the system via the ministries and commissions high-speed data network. Other data providers can link into the system via Internet directly. All access sessions and communications among nodes are based on Internet. Each node shall include the metadata management system, metadata search and retrieval system, data access and browse system, data obtain system and the spatial databases. The National Spatial Information Clearinghouse shall also include the nodes management module (NMS) and NREDIS spatial data warehouse except above five systems. The

nodes management module is used to registry, add, delete, configure the nodes in the system. NREDIS spatial data warehouse is a central system to extract and amalgamate the information from related spatial databases. It can satisfy the needs of spatial analysis and model analysis to certain users.

3.2. Metadata Management System

The metadata management system is one of the core systems of the National Spatial Information Network System. The data providers use it to generate the metadata database from related spatial data sets. The data providers can also manage, update and maintain the metadata databases throuht the metadata management system.

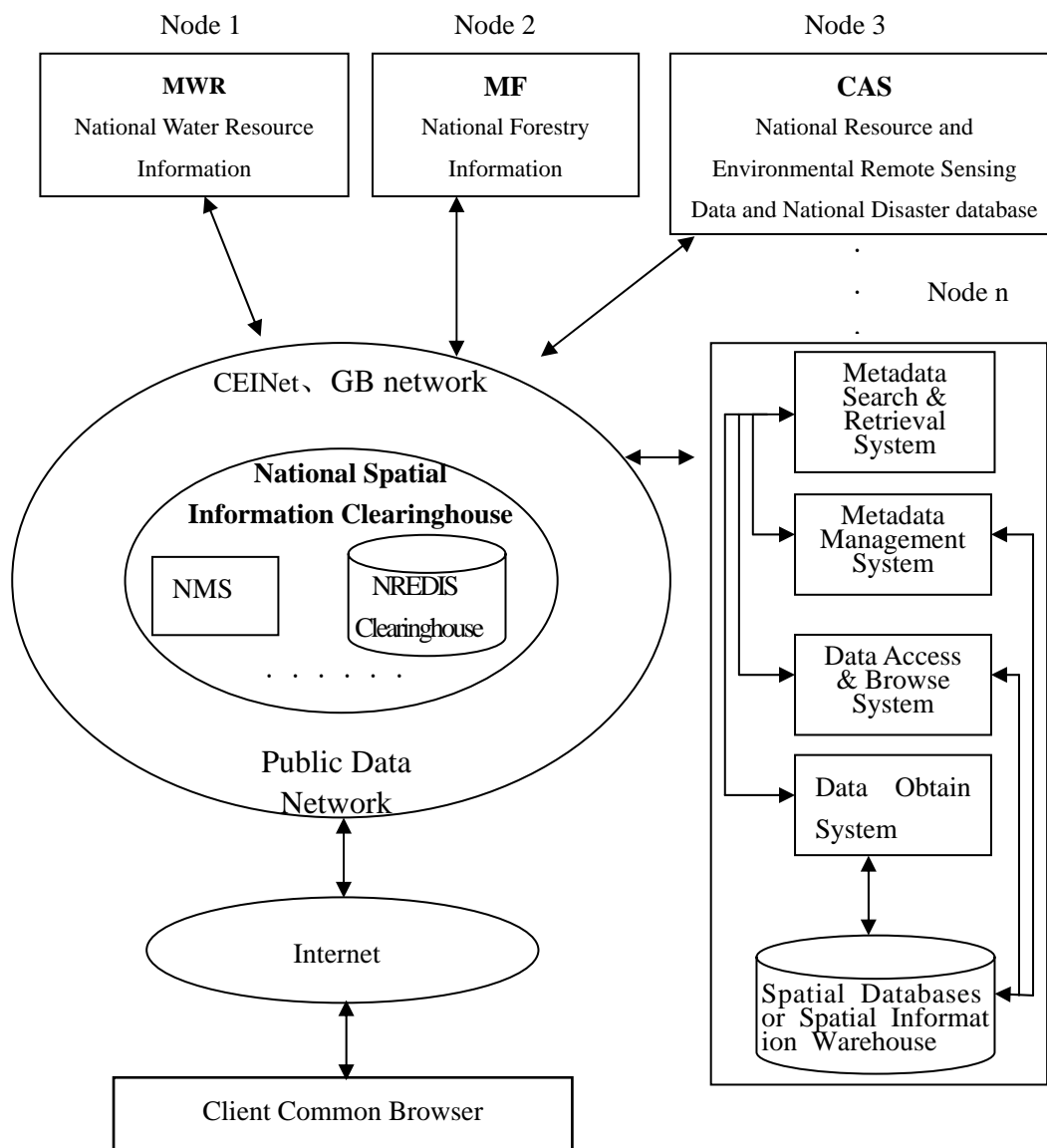


Figure 1. National Spatial Information Network System Architecture

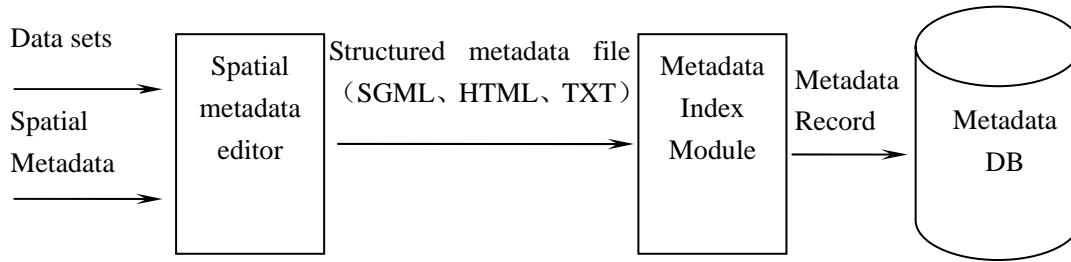


Figure 2 Metadata Loading In Metadata Management System

The metadata management system is mainly composed of the spatial metadata editor, the metadata index module and the metadata databases. The spatial metadata editor is developed according to the NSII Spatial Metadata Standard. It provides a user-friendly interface to enable users to edit the spatial metadata and output in multiple formats such as SGML, TXT, HTML. Then, users can index the metadata record and load it into the metadata database using the metadata index module (See Figure 2).

3.3. Spatial Metadata Search & Retrieval System

The Spatial Metadata Search & Retrieval System adopts the Client/Server architecture. It is independent of any plat and operation system. Communications between the metadata servers and spatial databases of each node in National Spatial Information Network System take place through the Internet. The Spatial Metadata Search & Retrieval System includes spatial metadata browser, WWW server, spatial metadata search and retrieval server and spatial metadata databases. Figure 3 shows the system architecture.

The spatial metadata browser can be any common Internet browser. Users send the requests such as browse, search from the browser to the

WWW server, spatial metadata search and retrieval server. The interface for user's browse and search is designed according to most users' search custom. Users can select the certain database or all databases to implement their search. They can also specify several search criteria such as words, program, location, date. The words entered by the user can be targeted against an entire metadata record or against specific fields, such as title, abstract, keyword etc., selected by the user.

The metadata search & retrieval server accesses the spatial metadata databases according to the request submitted by the browser, then accepts the search result and returns the results to the browser. The statistical function to the access log of data sets is also provided by the metadata search & retrieval server. It can store, manage the metadata of those users who have no distributed ability on Internet.

3.4. Data Access & Browse System

Data access & Browse System provides users a function of browsing spatial data set. After a user accesses metadata, he can give a request to WebGIS server from a browser, implement linking with WebGIS server, and access, browse the corresponding spatial data set.

Data Obtain System provides users a function of

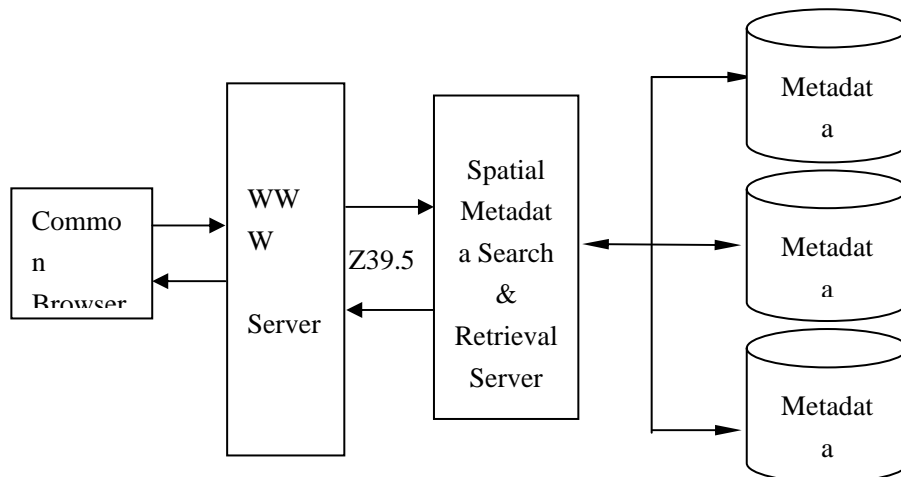


Figure 3 Spatial Metadata Search & Retrieval System Architecture

obtaining certain data set. Metadata has detailed description of obtain method of corresponding data set. When users choose download mode, and pass the identity, authentication check, users can link to the particular FTP server, and start the downloading session. When users need particular data format, they can give a request to spatial data transfer server to implement the data transfer without semantic loss. Spatial data transfer module is developed to implement the semantic loss transfer between different spatial data formats according to the NSII spatial data transfer standard and its implement program.

3.6. NREDIS Spatial Data Warehouse System

NREDIS spatial data warehouse system is a central system distributed in National Spatial Information Center. NREDIS spatial data warehouse is a central system to extract and amalgamate the formation from related spatial databases. It can satisfy the needs of spatial analysis and model analysis to support macro economic decision-making to certain users.

NREDIS spatial data warehouse system has analysis function on deep scale. It can integrate data according to the spatial object model, produce and store high information quantity data and

knowledge data. According to NSII spatial data transfer standard, the system can model spatial objects and organize the spatial data according to the spatial object model, and implement data transfer without semantic loss. NREDIS spatial data warehouse system support historical data, and can implement information analysis on time-sequence.

The construction of NSII and national resource environmental and regional economic information system is a developing and replenishing procedure. It refers to many advanced technologies. With the extent and deepen in its application fields, system functions and structure need develop incessantly. It need refer to experience of international related technology and related international standard to meet the needs of spatial information sharing farthest.

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