STUDY ON THE STANDARD ARCHITECTURE FOR GEOGRAPHIC INFORMATION

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Abstract
Geographic information is the four dimensional information supporting platform for integration of the social, economical and human cultural information. Geographic information standards play as the bridges and ligaments among the geographic information science, geographic information system and geographic information services. The standard architecture of geographic information is the guideline for designing an organism of standard in which the standards integrated to each other to promote the development, sharing and services of geographic information resources.
First of all, a brief introduction about the history of standardization in China is given, and it shows that the technical standards in the ancient days played a significant role. Such as the weights and measures of human-scale early exchange of commodities, typographic printing, traditional Chinese pharmaceutical were pushed the development of ancient Chinese civilization. And then, the status of geographic information standardization in China is reviewed, including of the standards development during the transformation from analog to digital surveying & mapping, the standard architectures studied by the related GIS application departments in the past 30 years and a brief introduction about the research institutions for geographic information standards.
To establish the standard architecture of geographic information is one of the main tasks of 'the eleventh five year plan of geographic information standard (2006-2010) '. After some research work, the scope of the standard architecture of geographic information is defined. The principles are settled down to accommodate the aim of the framework of standard architecture, such as across-the-board, adaptability, stability, extensible and suitable for internet environment. Adopting the viewpoints in the ISO RM ODP Model, classified the standards into 3 levels, and under these levels there are 7 standard categories, 44 sub- categories and more than 200 standards, relative standards are supporting the standard architecture.
Finally, the conclusions and challenges of the geographic information standards are rising out.

Keywords standard, geographic information standard, standard architecture of geographic information

Introduction

Standards are all around us and impact our daily lives in many ways. Whether we are sending a PDF document to a colleague, listening to music on a MP3 player, using a credit card, driving a car in a foreign country, or just expecting that the products we buy are safe and a high quality, standards that improve our lives wherever we are and whatever we are doing. Standardization is the human part of social practice. Standardization activities have been infiltrated into human society in all spheres of practical activities. The basic function of standardization activities are to sum up practical experiences, and make them popular.

Accordance with the rapid development of the global information, standardization has become the important technical basis works of the human economic activities and social development. One of the tasks for the 'Eleventh Five-Year' plan of Surveying & Mapping scientific and technological development is to establish the standards architecture of geographic information to promote the development of geographic information needs and sharing.

Geographic Information System GI System is a technology, a discipline, and an applied problem solving methodology and it is ubiquitous now after more than 40 years development. Geographic information Science (GI Science) may be defined as the basic research field that seeks to redefine geographic concepts and their use in the context of geographic information systems. GI Science re-examines some of the most fundamental themes in traditional spatially-oriented fields such as geography, cartography, and geodesy, while incorporating more recent developments in cognitive and information science. GI Science also overlaps with specialized research fields such as computer science, statistics, mathematics, and psychology, and contributes to progress in those fields. It supports research in political science and anthropology, and draws on those fields in studies of geographic information and society. This term was coined in a paper by Michael Goodchild published in 1992. Geographic information Service (GI Service) includes a variety of applications with different levels of functionality to access and use geographic information. GI '3S' (Systems, Science and Service) rely on and support each other (Figure 1.), and the GI Standard plays as a bridge transmission supplies throughout the three parts(Figure 2.).

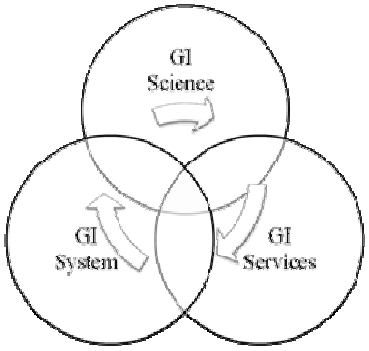

Figure1. Relations of GI '3S'

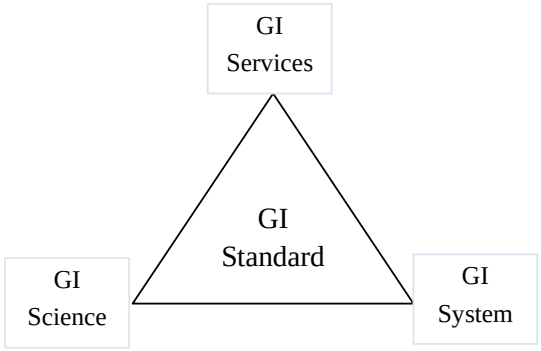

Figure 2. GI Standards with GI '3S'

Ancient Chinese standardization

As the saying goes, no rules no games, it reveals an important truth: make rules, understand the rules and abide by the rules. If there are no rules, social order will fall into conflict. From the perspective of science and technology, "the rules" can be considered as standards. Weights and measures of human-scale in the early days were used for exchange of commodities. The trading rule had been set at Shang and Zhou dynasties (3000 years ago) to promote the commercial development. . The Qin Dynasty (221 BC-206 BC) weights and measures were used to further harmonize and standardize the measurement apparatus; and unified the track of vehicles to regulate the country's roads which facilitated the exchange of traffic and goods. The invention of typographic printing by Scientist – Bisheng in the Northern Song Dynasty era (AD 1041 ~ 1048), he started to use the principles and methods from standardization, such as the unit, composition and decomposition, repeated sections, known as "a milestone in the development of standardized. Another example as "Compendium of Materia Medica", the book was written by Chinese medicine experts - LI Shizhen in Ming Dynasty (1518 ~ 1593) which described the types of drugs, characteristics and methods and medicine. All these proved that standards have been played an important role in the progress of human society.

Review of the Standardization of geographic information work in China

Geographic Information refers concerning phenomena implicitly or explicitly associated with a location relative to the earth, it is the foundational information of strategic resources for country's economic and social development, as an opportunity to integrate other kinds of socio-economic and cultural basis of statistical information platform. Geographic Information has been more and more widely used in the national economy, social development, national security and the public in all aspects of life and it is ubiquitous now. Standards of geographic information in China has experienced from a single standard to a series of standards, from only used in one area to involves a number of areas, from the traditional field of surveying and mapping, to the new technology development process of Geographic information. 20th century 80's, according with the high-tech development, especially in the popularization of computer technology, surveying & mapping made a big progress from analog mapping to digital mapping. A number of technical standards and regulations were developed and promoted this transformation. "Study on national standards of Resources and Environment Information System" (commonly known as the Blue Book) was published in 1983. During the "Tenth Five-Year Plan" period, earth observation technology, network and communication technology have been greatly involved in GIS, and a number of standards for navigation, location-based services, web-services were developed and published. By the end of 2004, more than 80 national standards of geographic information were revised. A great deal of geographic information professional standards and technical specifications were worked out from related fields as construction, transport, forestry, water conservancy, oceanography, environmental protection, agriculture, meteorology and other fields of industry. At the same time, amount of geographic information local standards were complied from Beijing,

Shanghai, Shenzhen, and economically developed areas.

The main institutions for Standardization in the china are Geo-Spatial Information Coordination Commission of China, Geographic Information Standardization Technical Commission of China (SAC/TC 230) and Standardization Institution of Surveying and Mapping of the State Bureau of Surveying and Mapping of China. Geo-Spatial Information Coordination Commission of China was formally founded in 1998 and sanctified by the State Department. One of its major functions is to organize, study and formulate the planning, standards, policies, and development strategies for the national spatial information infrastructure construction and GIS development. Geographic Information Standardization Technical Commission of China (SAC/TC 230) was established in 1997 and engaged in the field for the national level standardization of geographic information. The main responsibilities of SAC/TC 230 are planning, coordinating and organizing the national standards in the field of geographic information in order to make relevant and harmonize spatial data available for formulating, implementing, monitoring and evaluating community policy and for the citizen to access spatial information, It also charged for outreach activities and academic exchanges. The main responsibilities for Standardization Institution of Surveying and Mapping are standards and quality control for professional level geographic information standards and focus on the functional standards of Surveying & Mapping. In addition, Wuhan University, Chinese Academy of Sciences Institute of Geography, Chinese Academy of Surveying and Mapping and other tertiary institutions, research institutions and enterprises take part in the Standardization activities, especially for engaging in research talent, training, implementation and other aspects of the standards.

Study on standard architecture for geographic information

State Bureau of Surveying and Mapping and the National Standardization Administration Committee jointly issued the "Eleventh Five-Year Plan of national geographic information standardization" in 2006. The main goals are to improve the construction of geographic information resources, development, sharing and use of geographic information and supporting the rapid development of geographic information industries and promoting the service level on economic and social development capacity. The "Eleventh Five-Year Plan" proposed by the six main tasks, namely: the establishment of national standard architecture for geographic information, the focus areas in urgent need of formulating and revising a number of basic standards for applied, adopting the international standards and advanced standards in abroad, pre-study to explore standards for conformance testing and evaluation system, and train and implementation of GI standards. By the end of the "Eleventh Five-Year Plan", the life-cycle for national standards should be less than 5 years; the ratio of adopting international standards and foreign advanced standards will be more than 60%, promote the practicality, suitability, reduce and harmonize the conflicts within standards, improve the management and coordination mechanisms.

Geographic Information Science and Technology is an interdisciplinary integration of science and technology. The aim of Standard architecture is to develop a structured

series of standards, including the existing and planning standards, linked with the relevant standards. The Standards in the architecture are dealing with the issues in defined geographic information data model, data structure, data processing, analysis, storage, access, presentation and exchange the geographic information with the users with different systems, different location, and different requirements.

First of all, most of the standards related with geographic information are collected, and after the statistic and analysis of the distribution of the standards, the weak points are found out that standards for service and products are less than 10%, this is far lag behind the requirements. Searching on the relation with professional subjects, trade and administrative departments by rules of direct related, indirect related and irrelative, 2/3 of them are directly related with geographic information, and the scope of the standard architecture for geographic information is defined. Perspective analysis is the best tool to define the standard architecture. ISO/TC 211 proposed standard from the following perspective on the five criteria and classification of objects (Figure 3.).

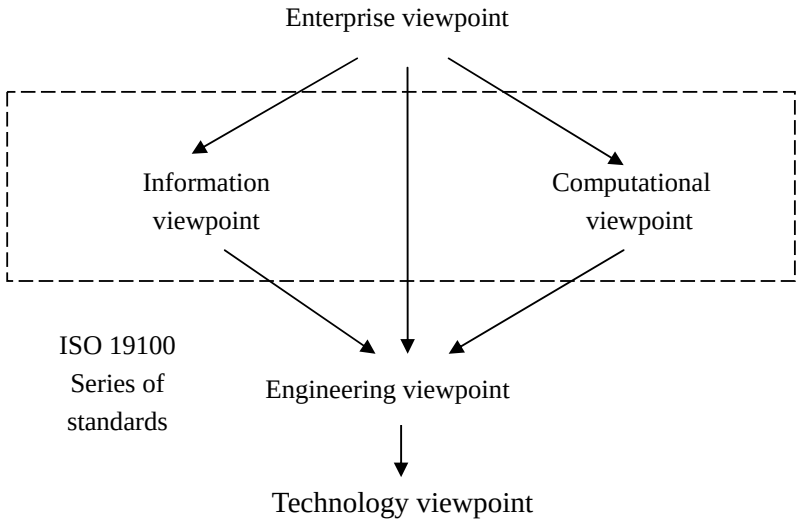

Figure3. Viewpoints in ISO RM ODP Model

Adopting the viewpoints of information and computing from the Viewpoints in the ISO RM ODP Model, classified the standards into 3 levels, as general level, professional level (interface with related thematic subjects),and engineering application level (Figure 4). UML (Unified Modeling Language) as the conceptual schema language for developing the framework of standard architecture for geographic information followed ISO 19103. The principles are settled down to accommodate the aim of the Standard Architecture for Geographic information, such as across-the-board, adaptability, stability, extensible and suitable for internet environment. There are 7 standard categories under the 3 levels, and 5 sub- categories and 29 classes in general level, 11 sub- categories in the professional level and 4 sub- categories in the engineering application level. (Figure5).

There are more than 200 standards in the standard architecture of geographic information (not including the relevant standards). The name of these standards are not

listed, the percentage of each class are as following, for general concepts (14%), data resources(39%); application & services(26%), environment and tools(5%); management (11%) and the others are for the standards in professional and engineering level.

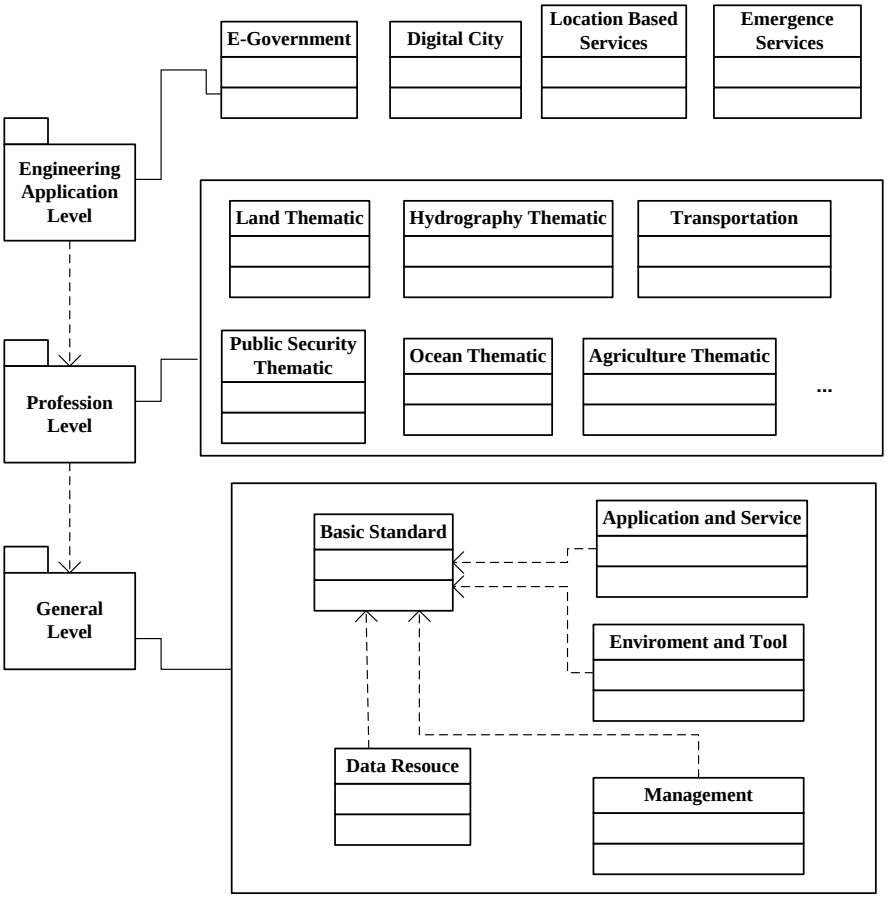

Figure 4. 3 levels in Standard architecture

Conclusion & challenges

A standard is an agreed, repeatable way of doing thing. It is a published document that contains a technical specification or other precise criteria designed to be used consistently as a rule, guideline, or definition. Standards help to make life simpler and to increase the reliability and the effectiveness of many goods and services we use. They are intended to be aspiration - a summary of good and best practice rather than general practice. Standards are created by bringing together the experience and expertise of all interested parties such as the producers, sellers, buyers, users and regulators of a particular material, product, process or service. Geographic information standards play as the bridges and ligaments among the geographic information science, geographic information system and geographic information services. The standard architecture for geographic information standards is the guideline for designing an organism in which the standards integrated to each other to promote the development, sharing and services of Geographic information resources. The main challenges we are

facing right now are as following:

- Harmonise and Revise the existing standards
- Develop Spatial Data Inter-operational Standards and Agreements
- Address new requirements.

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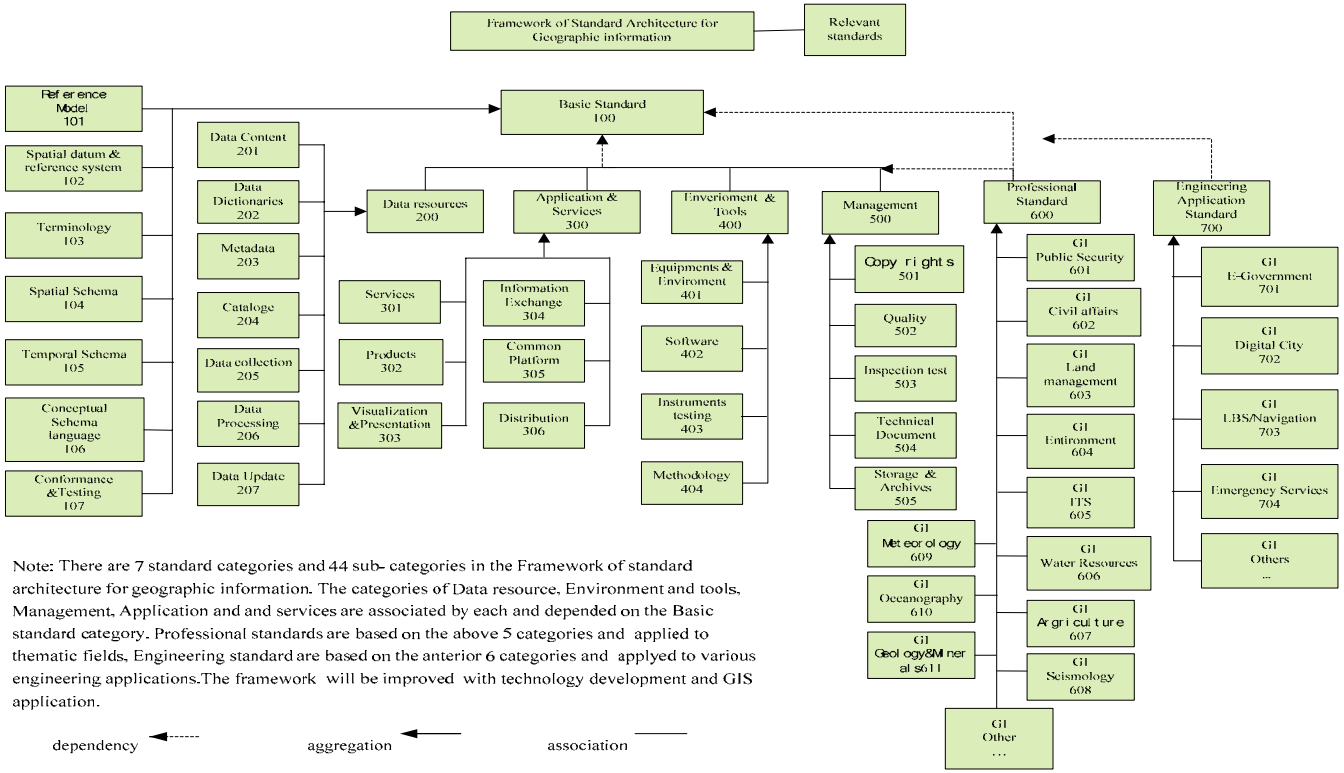

Figure5. The framework of the standard architecture