Construction and application of spatiotemporal information infrastructure and service standard system

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Abstract: Based on the current application of geospatial technology in China, this paper constructs the hierarchical structure and category definition of the framework of spatiotemporal information infrastructure and service standard system according to the actual requirements of spatiotemporal information infrastructure and service standards, and expounds its future application and development trend. In order to provide reference for the future development of spatiotemporal information industry.

1. Introduction
Spatiotemporal information infrastructure refers to the general term of facilities with temporal and spatial characteristics, including basic geographic information, thematic information related to public management and public services, and their operating environment and supporting environment [1]. The construction of spatiotemporal information infrastructure refers to the overview of the construction of integrated facilities of sky, earth and sea that provide spatiotemporal information products and services for the vast number of users by using spatiotemporal information resources [2]. At present, driven by the integration and development of space science, Internet technology, cloud platform, virtual reality and modern intelligent manufacturing technology, it has brought about changes in the production mode and service mode of surveying and mapping geographic information products, such as the massive and real-time surveying and mapping geographic information data, the dynamic, multi-source and fast processing of information acquisition, and services convenience and networking become the new normal [3]. The development of these new technologies and the changes brought about by them are not solved by the current surveying and mapping and geographic information standards which are mainly based on the category of geographic space. Therefore, it is necessary to build a standard system framework for the construction of spatiotemporal information infrastructure and services, reflect the need for standardization of information technology in the field of spatiotemporal information technology, guide the formulation and implementation of spatiotemporal information technology standards, improve the application and service level of spatiotemporal information technology, and promote the rapid development of spatiotemporal information industry.

2. Spatiotemporal information infrastructure and service standard system framework construction
Based on the actual needs of infrastructure construction and service development in the field of spatiotemporal information, the framework of spatiotemporal information infrastructure and service standard system is divided into five dimensions, namely, information perspective, technology perspective, engineering perspective, enterprise perspective and domain perspective, according to the...
perspective adapted to which the standardized object fits[4]. The framework adopts a top-down hierarchical structure, which is composed of 5 categories, 26 subclasses and other relevant standards, including basic general category, acquisition and processing category, application and service category, quality and evaluation category and special application category. Among them, the first four categories are general domain standards for spatiotemporal information infrastructure and services, and the fifth category adds special domain standards to meet the specific needs of spatiotemporal infrastructure and services in various special application fields, which is a further expansion of spatiotemporal information infrastructure and services standards.

The framework of building spatiotemporal information infrastructure and service standard system is shown in figure 1. The hierarchy and scope of the framework are shown in table 1.

Figure 1 framework of spatiotemporal information infrastructure and service standard system framework
In order to enable all parties involved in standardization to achieve a relatively consistent understanding of the spatiotemporal domain within a certain range of time and space [4], the basic standards are formulated with the common semantics, benchmarks, codes and models of the spatiotemporal domain as the objects.

| Categories name     | Categories range | Subclass name          | Subclass range                                                                 |
|---------------------|------------------|------------------------|--------------------------------------------------------------------------------|
| Basic               | general          | Reference model        | Define the goals, structural framework, standards and basic principles of standardization of spatiotemporal information |
|                     | 100              | Semantic model         | The semantic ontology model, semantic expression method, information fusion based on semantic position, semantic transformation based on position and related technical specification of spatiotemporal information are defined |
|                     |                  | Spatiotemporal         | Basic reference data and starting data of measurement in time and geospatial dimensions |
|                     |                  | benchmark              | Specify the content, structure, labeling and format of metadata of spatiotemporal information elements, images, datasets, databases and data achievements |
|                     |                  | 103 metadata           |                                                                                   |
|                     |                  | Classification coding  | Specify the classification, coding, code structure and composition, code table, etc. of spatiotemporal information elements, images, databases, data sets, etc |
|                     |                  | 105                    |                                                                                   |
|                     |                  | Schema symbol          | Define the schema and symbol related to spatiotemporal information elements         |
|                     |                  | 106                    |                                                                                   |
|                     |                  | Term                   | Define the basic terms of spatiotemporal information and the professional terms and business terms of spatiotemporal information |
|                     |                  | 107                    |                                                                                   |
|                     |                  | Data dictionary        | For the construction and application of spatiotemporal information database, the content, data organization, structure and format of geographic elements are defined and described |
|                     |                  | 108                    |                                                                                   |
|                     |                  | Holographic position   | Define the schema expression and usage specification of data visualization elements to describe spatiotemporal information |
|                     |                  | expression             | 109                                                                                   |

In order to standardize the technical requirements and technical parameters of each link in the process of acquiring and processing spatiotemporal information, the standards are set for the acquisition and processing of spatiotemporal information data such as aerospace, aviation, low altitude, ground, underground, marine, indoor, and other technologies, equipment, methods, processes, behaviors, etc.

| Data acquisition     | 201 Data processing | 202 |
|----------------------|---------------------|-----|
| Stipulate the technical index requirements of space, aviation, low altitude, ground, underground, ocean, indoor and other spatiotemporal information data acquisition environment, technology, method, process and results, etc |
| Stipulate the processing environment, technology, method, process, achievement and technical index requirements based on data security control of space, aviation, low altitude, ground, underground, ocean, indoor and other spatiotemporal information data |

Standards formulated for the construction and application services of products, information platforms and other general-purpose infrastructure generated by spatiotemporal information technology within a certain time and space.

| Product             | 301 Information platform | 302 |
|---------------------|--------------------------|-----|
| Stipulate the technology, management and relevant requirements of spatiotemporal information products |
| Stipulate the infrastructure construction, service content, technical requirements (including operation environment and support environment), evaluation indexes and service requirements of spatiotemporal information data and cloud platform |

| Sharing and integration | 303 Spatiotemporal location service | 304 |
|-------------------------|------------------------------------|-----|
| Association, exchange, methods and application specifications of data resource sharing and integration for spatiotemporal information application services |
| The definition and description of general location service information of specified spatiotemporal information, the content, technical specifications and service requirements of navigation and location service infrastructure and data, etc. [4] |

| National conditions monitoring service | 305 Emergency service | 306 |
|---------------------------------------|----------------------|-----|
| Stipulate the technical indicators, technical specifications, service requirements, etc. of spatiotemporal information geographic situation monitoring application services |
| Stipulate the content, technical indicators and requirements of spatiotemporal information emergency services and service requirements, etc. |

| Other application service | 307 Quality and evaluation     | 400 |
|---------------------------|--------------------------------|-----|
| Stipulate the content, technical indicators, requirements and service requirements of other application services of spatiotemporal information |
| Stipulate the quality requirements, safety requirements, testing and evaluation specifications of spatiotemporal information products, data systems and infrastructure |

| Product quality and evaluation | 401 Facility quality and evaluation | 402 |
|-------------------------------|------------------------------------|-----|
| Stipulate the quality requirements and evaluation standards of spatiotemporal information services |
| Stipulate the quality requirements, safety requirements, testing and evaluation specifications for infrastructure such as spatiotemporal information cloud platform |

| Service quality and evaluation | 403 Special application service    | 500 |
|--------------------------------|-----------------------------------|-----|
| Stipulate the quality requirements and evaluation standards of spatiotemporal information services |
| Based on the construction and application service of general spatiotemporal information infrastructure, the standard is formulated for the construction and application service of special field spatiotemporal infrastructure |

| Electronic commerce | 501 Electronic government | 502 Smart city | 503 Belt and road | 504 Other special items | 505 |
|---------------------|--------------------------|---------------|------------------|-----------------------|-----|
| The construction of spatiotemporal information infrastructure and application service standards in the field of electronic commerce |
| The construction of spatiotemporal information infrastructure and application service standards in the field of electronic government |
| The construction of spatiotemporal information infrastructure and application service standards in the field of smart city |
| The construction of spatiotemporal information infrastructure and application service standards in the field of the belt and road |
| The construction of spatiotemporal information infrastructure and application service standards in the field of other special items |
3. Application and Prospect

At present, driven by the new generation of information technology, such as intelligent perception, automatic interpretation, wireless communication, etc. [5], the spatiotemporal data of China's geographic information industry has more and more obvious for large-scale, cross-industry integration and wide participation, and has a wide application prospect in urban management, public transportation, disaster reduction and epidemic prevention, medical care, public safety, environmental protection monitoring, social security, etc., such as city sensors, precise time and space positioning, high-resolution satellite remote sensing, UAV low-altitude image measurement, tilt photography, bike sharing, driverless, temporal smart grid, intelligent Internet of things, etc. In the future, spatiotemporal information infrastructure and service will put forward to meet the diversity need of personalization, specialization, scale and intelligence [6-8], it puts forward the requirements for the integration and application of spatiotemporal information resources from data, format, file to higher level of semantic and service sharing; it puts forward the development and application of spatiotemporal information platform from distributed to cross efficient resource management requirements of cloud computing. In order to meet the challenges brought by these application needs and the increasingly updated social development needs, it is necessary to further build and improve the standard system of spatiotemporal information infrastructure and service based on the existing geographic information standard system and surveying and mapping standard system, supplement the relevant standards and specifications of spatiotemporal basic information and data fusion at the basic level of spatiotemporal information content, and acquire and expand the standard sequence of processing means, develop relevant technical specifications in spatiotemporal information sharing, online service and spatiotemporal information integration service of sky, earth and sea integration, timely provide general and special application and service standards and specifications related to spatiotemporal information products, big data, cloud platform, etc., and provide guarantee for the quality and evaluation of these new products and application services to meet the domestic demand for spatiotemporal infrastructure construction and future industrial development.

4. Conclusion

Based on the current demand of spatiotemporal information technology for standardization in China, this paper first studies and constructs a framework of spatiotemporal information infrastructure and service standard system including 5 categories and 26 subclasses in the domestic, including general application field standards and special application field standards, which are connected with the current geographic information standard system and surveying and mapping standard system in terms of framework, standard content, etc. To form an organic whole that complements and supports each other.

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