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ORIGINAL RESEARCH

Study of the key technology on the Geo-hazard spatial information sharing platform in Meizoseismal Region of Wenchuan Earthquake Zone

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Abstract
With great changes in global climate and unusual and extreme weather in recent years, the geological disaster happens more frequently than ever before, so people attach more and more importance to the geo-disaster defending and decreasing for the social economic development especially after the great earthquake in Wenchuan, Sichuan province. As our nation's great strategy informational source, Geo-hazard information is the key technology in the area of government managing decision, which plays an important role in a project. How to use it has become the key problem. The development of new industry and the promotion of life conditions makes the service based on the geo-information in huge demand. Geo-hazard spatial information sharing service platform is to build a basic spatial information sharing environment. In this environment, the information will be shared in the form of Web services for government agencies, businesses, and the public, provided that geological hazard specifications and standards are followed. Actually, with the development of Internet technology and cloud computing, preliminary results have been achieved on the problem of geographic information sharing and corresponding evaluation work has been carried out. Based on the idea of disaster ontology, the geographic shared service framework is designed and expounded, which is adapted to Wenchuan zone by using data catalog rules. The geo-shared service model is derived from Geo-hazard Spatial Information Sharing Service Model. The design of service interface is expounded. The evaluation and application as well as effective system test is finished based on the Wenchuan geo-disaster evaluation and application system.

Keywords Geo-hazard · Sharing service · SOA · GeoWeb

1 Introduction

The application and service of geological hazard spatial information has the characteristics of cross-region, cross-specialty and real-time update. When facing some applications and services, you need to use the basic data from different regions, different specialties and different companies. Therefore, we need new information technology to conduct interoperation on the Internet and improve service levels (Zhang et al. 2000; Yin 2004; Huang et al. 2016).

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After the Wenchuan Earthquake, some experts hold the opinion that in order to evaluate the safety of the post-disaster and take effective actions, China should build a database of earthquake disaster (Yao and Yang 2016; Jia et al. 2016). "It is very helpful to build a data base for predicting and forecasting similar disasters," they said. In fact, the construction of database is not only of great significance, but also for the information construction of disaster-related population and economy, as well as the integration and sharing of these information and disaster data. However, comparing to overseas, China has a lower level of construction of disaster data base and a poorer standard of data sharing. It's necessary to study and discuss the international standards of constructing data base and methods of sharing disaster-related data.

Disaster data acquisition technology mainly includes remote sensing technology (Lu 2018; Xie 2011; Wang et al. 2016), UAV low altitude photogrammetry technology (Xiao et al. 2013; Deng 2017), mobile GIS technology (Zhang

2010; Xu 2015; Yang et al. 2016) (GPS positioning technology, portable equipment, mobile communication technology and GIS spatial information processing capacity). According to the terrain data, it is difficult for human beings to reach the disaster sites such as glaciers, frozen lakes, landslides, mudslides and quake lakes, which may even pose a major threat to these places. The technology can carry out the interpretation and analysis of the situation of disaster-pregnant environmental in the study area, and then obtain the data background, the disaster-pregnant data, disaster-causing environment of the whole area in different spatial scales and some key disaster points. Visualization plays a key role in the information world, and the regional difference of geographic information determines the diversity of geographic information visualization (Du et al. 2018). WebGIS is the extension and development of traditional GIS technology in the network technology. It not only has the traditional GIS function, but also can realize the spatial information release, sharing and collaborative communication in the network environment. It has the advantages of wide range of customer access, scalability, cross platform, interoperability and distribution (Li 2011a, b). Zhao et al. (2014) proposed an emergency management system architecture based on Web service and service-oriented architecture SOA for various natural disasters and public security emergencies. Liang (2015) used Ajax technology and Webservice technology to develop the geological disaster management information system in the environment of Visual Studio 2010. Wang (2010) put forward a method of integrating all kinds of disaster data based on unified geographic coding with geographical framework data as the carrier, and realized the heterogeneous disaster data sharing of different departments.

How to improve management and sharing of geo-hazard information and provide basic guarantee for geological disaster prevention and emergency work is one of the most crucial problems of Chinese geo-hazard information construction. With the rapid development and wide application of web GIS, the demand of reliable information service of geo-hazard from government and society is growing. Constructing a public service platform for geological disaster spatial information has a realistic significance, as well as benefits the whole society.

2 Geological disaster sharing service platform architecture

"The Sharing Service platform for geo-hazard spatial information" (Geo-hazard Shared Services Platform) has three-level and three-tier structure system.

Geo-hazard Shared Services Platform is composed of master node, partial node and information base, according to the difference in administrative construction level of Geo-hazard Shared Services Platform and the demand of the circulation of geo-hazard information from central to local. Master node, partial node and information base separately base on geo-hazard service institutions in country, province and city (or county). Each level of nodes manages targeted data of different precision, the link of every nodes implements interoperability by e-government network.

According to the specific content of Geo-hazard Shared Services Platform, we can divide it into three tiers of technical structure.

Three tiers of technical structure mean a data tier, a service tier and an application tier, as is shown in Fig. 1. The whole system of Geo-hazard Shared Services Platform is composed of the three tiers, and based on Geo-hazard Shared Services Platform we can build some professional application systems.

1. Data tier: main content is basic geographical framework data and geo-hazard data. Geographical framework data uses distributed storage and management model, arranged by three levels of country, province and city (county). Every data should remain same in logic and flow in physic, and can be used with the way of "construct and share together".
2. Service tier: a series of standard service interfaces are designed and implemented according to the common needs of most users for basic geographic information applications, and the portal website system, online service system and service management system are built on this basis. Professional users can realize the distributed integration of platform geographic information and their own business information through the interface and quickly build the business application system. Ordinary users can access various on-line geographical information via portal sites.
3. Application tier: Geo-hazard business application is based on geo-hazard shared service platform, like geo-hazard risk venation application, disaster mitigation and prevention decision support application, and disaster prediction etc., while the shared service platform can get geo-hazard data source from geo-hazard data tier.

3 The construction of geo-hazard sharing services platform

3.1 The standards system design of geo-hazard sharing services platform

In accordance with the provisions of China's standardization law and the requirements of relevant standardized documents, the following principles should be followed to achieve the goal of standardization in the process of system

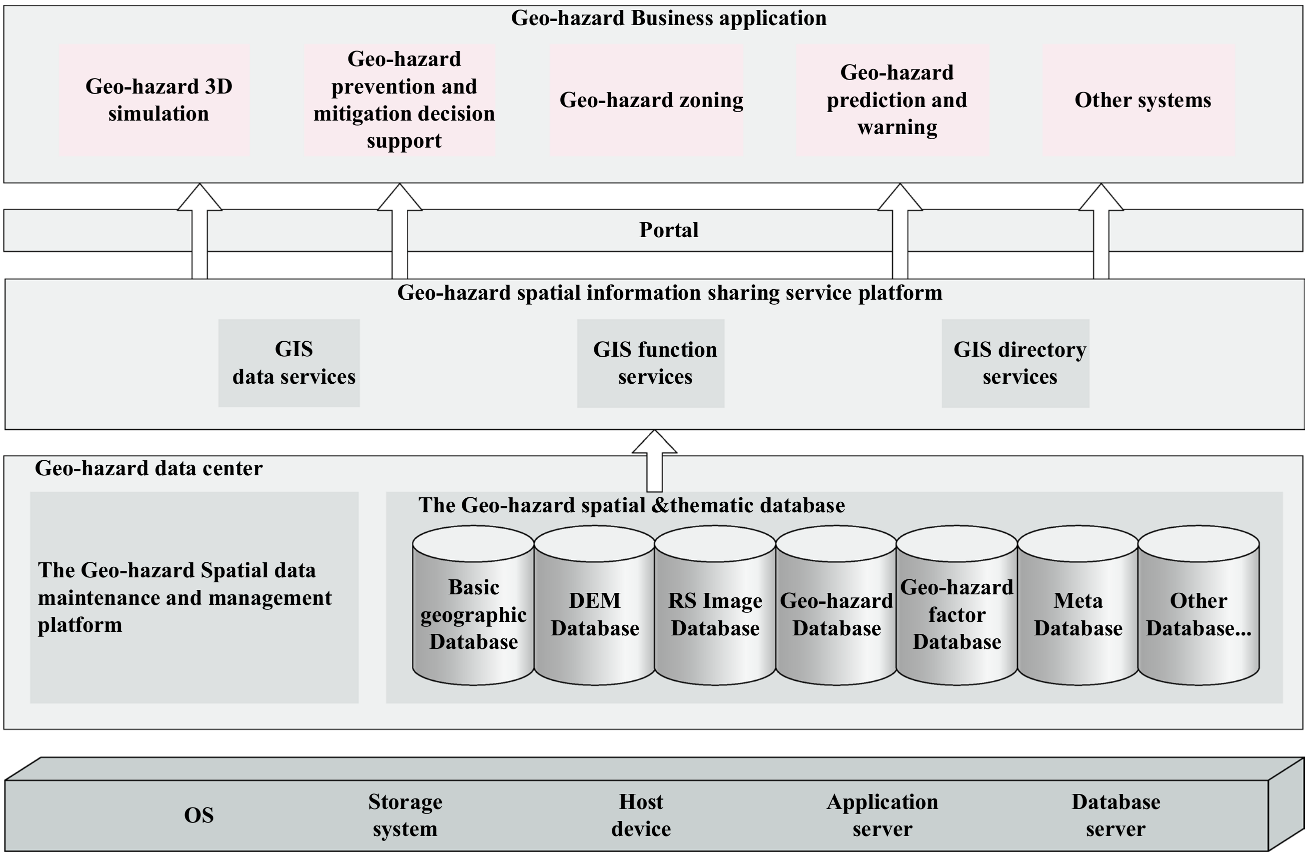

Fig. 1 General framework of Geo-hazard shared services platform

design, construction and system application of geological disaster spatial information sharing platform:

1. For the technical requirement that needs to be unified in the system, if there are national standards, the existing national standards (GB) must be implemented.
2. If there are no national standards and there are corresponding industry standards, the corresponding industry standards shall be implemented.
3. If there are no national or industry standards, but there are existing local standards, the existing local standards shall be implemented.
4. If there are no national standards, no industry standards, no corresponding local standards, but there are corresponding international standards or similar foreign advanced standards, the technical requirement can first refer to the use of international standards or foreign advanced standards, at the same time, it is recommended to establish the corresponding Chinese standards.
5. If the technical requirement has no any related standards, but has related internal standards or technical guidance document, it should use related documents to create conditions actively, speed up the application project and set related standards according to certain procedures.

3.2 The construction of geo-hazard spatial information data center and management platform

3.2.1 Design of Geo-hazard spatial database

The spatial database mainly includes basic spatial geographic data, basic geology and topography data and geo-hazard data according to the data design task of geo-hazard sharing services platform.

1. The design of basic spatial geographic data

   Geographic entity data includes basic geographic entity and extended geographic entity. Basic geographic entity is formed on content extraction, level-division refinement, model reconstruction and statistical analysis of basic geographic information data, including realm and administrative region entities, road entities, railway entities, parcel entities, building entities, courtyard entities, rivers entities, geographical statistics measuring data, etc. The data source of national level geographic entity data mainly comes from 1:50,000 and small-scale basic geographic information data. The data source of provincial level data mainly comes from the 1:10000

data. The data source of municipal level data mainly comes from 1:2000 and large-scale data for the data source.
2. Data design of the basic geological and geo-hazard.

Recently published information, maps, documents about geological disasters; 1:500,000 environmental geology investigation reports of geological disaster-prone areas (such as Yunnan, Sichuan, Guangxi) and provincial geological disasters flood season reports, and investigation reports in recent years; the original information of the provincial geological disasters registration table, statistical table, cards and geological disaster field investigations table; some resources remote sensing reports of provinces and cities.

The basic geological layers mainly include seismic point layer, seismic intensity zoning layer, geotechnical type layers, hydro geological layer, active faults layer and stratum occurrence layer.

Geological disasters distribution layer mainly includes six common geological disasters, namely the landslide distribution layer, collapses distribution layer, mud-rock flow distribution layer, ground fissures distribution layer, ground subsidence distribution layer and frozen ground disaster distribution layer.

Other layers include geo-hazard partition layer, geo-hazard dangerousness classification layer and geo-hazard risk zoning layer.

3.2.2 Design of Geo-hazard spatial data exchange center

Sharing and exchanging of geo-hazard spatial data are that different users who use different computers and software can read, operate and analyze others' data in different places. Due to the differences in data format offered by different departments, we can fail in transforming or lose information after data format transformation sometimes, which prevent data from circulating and sharing in different departments and software severely.

Spatial data exchange standard is the base of heterogeneous distributed spatial database sharing.

Spatial data exchange format includes three parts divided by data classification:

1. Vector data exchange mode
   Set rules of feature classification of geometric figures, composition of vector data (geometric figures data and property data), composition and format of vector data exchange file, description and structure of file header, element type parameter, structure and format of property data, content and format of geometric figures, content and format of annotation, etc.
2. Image data exchange mode
   Use images whose format is international industrial standard uncompressed TIFF or BMP etc, with adding information, such as location information of geodetic coordinate and ground resolution of pixel. The added information should write another file with formatting plain text format, instead of destroying the current format of TIFF or BMP.
3. Grid data exchange mode

Rules of the composition of grid data, the information classification of file header, composition and grid of gird data in exchange format.

3.3 The disaster of ontology data classification

The main basis of the current classification of geological hazards is classified, according to the data directory description. Similar to the Windows resource management mode, this kind of classification has a tree hierarchy, which is a gradual development directory tree classification management. The advantages of this classification are that the inter-layer boundaries are clear, no capacity constraints, accord with human classification knowledge. However, in the process of classification, the vertical relationship of data is preserved, and the horizontal relationship between different data types is broken, resulting in the lack of data semantics, relationship substitution redundancy, and difficulty in understanding by computers.

1. Principle of data classification based on the ontology
   According to principle of classification ontology data, ontology can describe feature assemble, relation of classes, and define relation with relation (meta relationship). This ontology characteristic determines that classification according to ontology can be not only easily described in the model language, which is easy for the computer to understand, but also better retain data semantics, reduce alternative data redundancy and better avoid the limitations and problems of traditional classification.
2. Classification of geo-hazard data based on ontology

A preliminary complete geo-hazard notion framework should include: definition of different hazard kinds, definition of hazard causes, definition of disaster-pregnant, definition of disaster-affected body. And geo-hazard ontology is built on the basis of this framework (Wang 2010).

Geo-hazard data can be divided into disaster-causing factor data, disaster-pregnant data, disaster-affected body and data of disaster condition (Kayi et al. 2014), as is shown in Fig. 2. Disaster condition is consisted of interaction among disaster-pregnant environment, disaster-causing factor, disaster-affected body. What decide the scale of disaster are

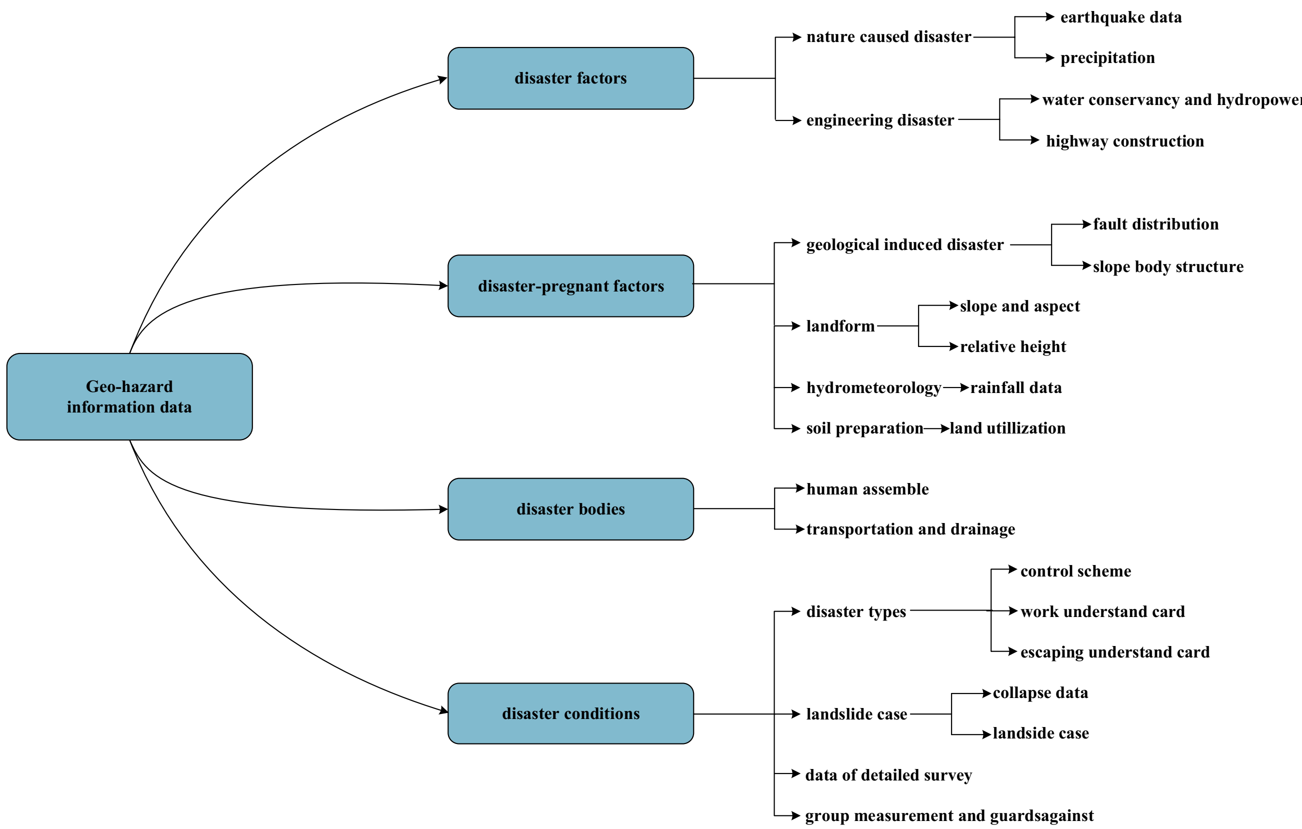

Fig. 2 The natural disaster data classification system diagram

the stability of disaster-pregnant, the risk of disaster-causing factor and the vulnerability of disaster-affected body (Fan 2004). In each stage of disaster prevention, preparedness, emergency relief and post-disaster reconstruction, it is necessary to take into full account the data of all aspects of the disaster area and carry out targeted work (Arslan et al. 2005; Wirtz et al. 2014; Qiu 2017; Yu et al. 2018).

3.4 Geo-hazard Spatial Information Sharing Service Model Construction

Based on SOA, a model defined GSISSM is designed (Yang et al. 2010; Liang 2011), as is shown in Fig. 3. The Service Modeling is divided into six layers from top to bottom and from left to right according to the functional requirements and hierarchical service model idea, namely the operation support layer, the data layer, the service layer, the application layer, the enterprise service bus layer (ESB) and the standard layer. The concept and classification of geospatial data sharing service is studied and discussed by integrating various services by ESB. The second layer on the right is the Shared standard, the disaster industry standard and standard system, and the security system to ensure the integrity and effectiveness of the layered model.

3.4.1 Operation support layer design

The operation support layer includes physical environments such as server cluster systems, network systems, storage backup systems and security systems, as well as soft environments such as technical specifications and management methods.

The platform builds a highly available database server cluster system to meet the large-scale concurrent and continuous access and collaborative application of massive spatial geographic information by governments, professional departments and the public, realizing continuous 24-h reallime services.

The platform builds a dedicated storage area network to achieve online integrated and optimized management of data. At the same time, an off-site disaster recovery storage backup system is constructed to store off-site copies of the main public geographic framework data and application systems to prevent major data and application systems caused by accidents Loss.

The platform builds a security and confidentiality system based on the e-government private network. In accordance with national standards for security and confidentiality, laws and regulations, and the spirit of documents, it adopts

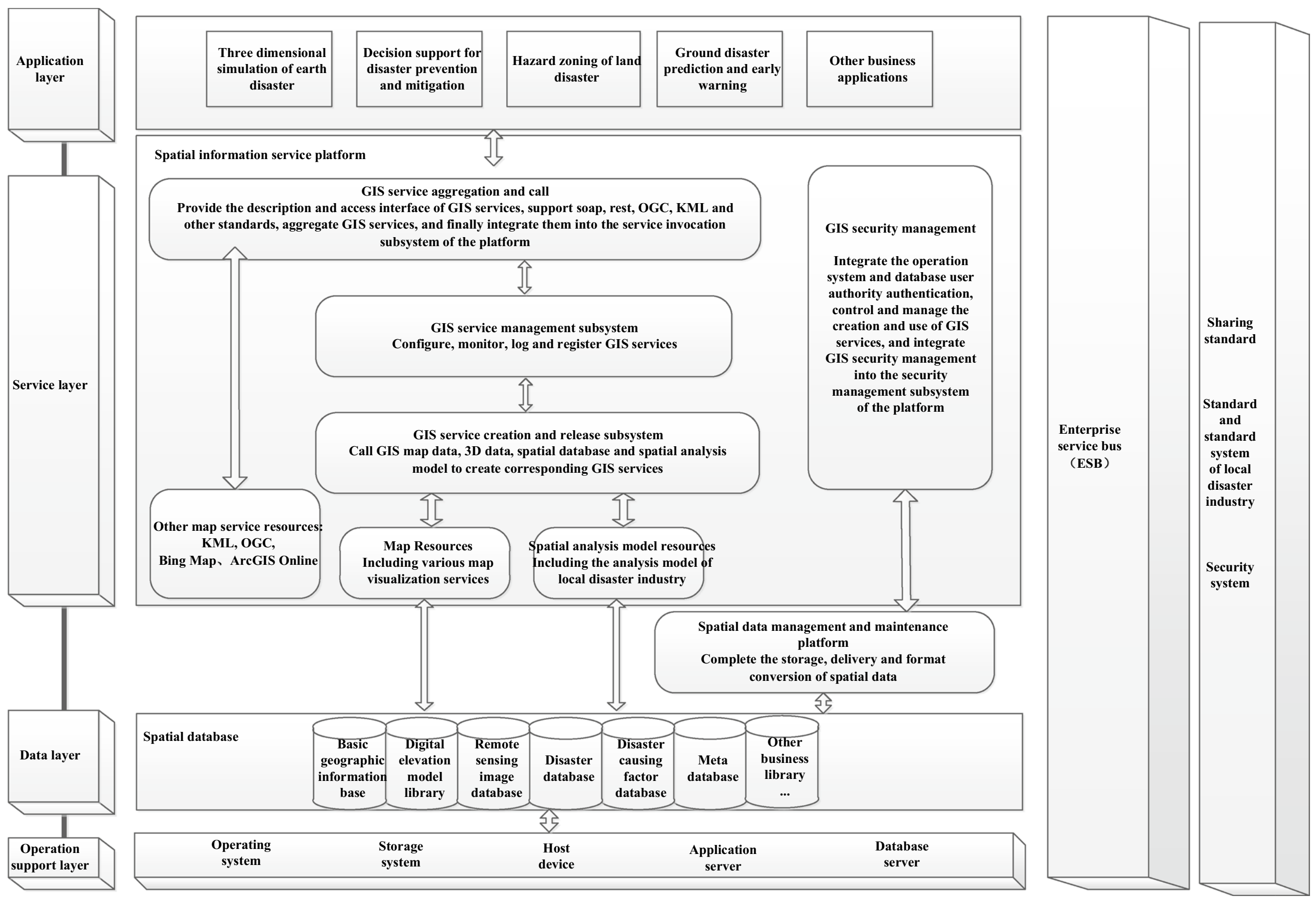

Fig. 3 Geo-hazard spatial information sharing service hierarchical model (GSISSM)

a hierarchical protection strategy from four levels: physical security, operational security, information security, and security management to carry out hierarchical protection and hierarchical protection construction of computer information systems and achieve unified security and confidentiality monitoring and management throughout the network.

3.4.2 Data layer design

(1) Frame data production processing system.

The framework data production processing system mainly includes image and vector data processing subsystems. The data source mainly targets the traditional 4d format data of basic surveying and mapping.

For image data, it provides common image data processing functions such as image mosaic, uniformity, and fusion.

For vector data, firstly, the mature and perfect data structure provided by ArcGIS is used to implement a scalable data model that meets the requirements of data specifications. Secondly, an extension module based on ArcGIS data interoperation provides data ETL functions for data processing operations.

① Design of data model.

In accordance with the requirements of the data specification, based on the ArcGIS Geodatabase data model, a geographic entity data model for the frame database is designed and implemented.

Based on this data model, the schema model structure of geographic entity data is standardized uniformly, and the content of the data is standardized to a certain extent by means of range and subclasses.

② Data ETL.

ETL is a process of data extraction, transformation, and loading. The user extracts the required data from the data source, cleans the data, and finally loads the data into the target data according to a predefined data model. In the container, the target container can be a database or a specific file format. The main core of this function is the design of data conversion rules.

The main data conversion rules supported by the ArcGIS ETL function include data filtering operations for attribute items, fields and filter statements, and arithmetic processing operations for data content, such as mathematical calculations and data format processing.

(2) Data maintenance and update.

The data of the "Geological Disaster Sharing Service Platform" adopts the "co-construction and sharing, collaborative update" mechanism, and in a distributed storage and management mode, relevant provincial and municipal departments carry out the construction and maintenance of the data layer of this node in accordance with unified data specifications. All data resources are logically consistent, physically distributed, and interconnected.

The platform data update adopts two modes: emergency quick update and regular update, including the process of extracting change information, coordinating element relationships, and versioning management.

① Emergency update.

In the event of an emergency or emergency, various technical means and methods are adopted to quickly obtain aerospace image data, ground-based measured data and related thematic data at the event location or relevant area, extract change information and update public geographic framework data in a timely manner. To provide platform users with the latest information services to meet emergency disaster and risk management needs.

② Daily update.

Based on the regular update plan of basic geographic information data, the updated information is used to update the data of public geographic framework in a timely manner. The key is to establish a consistent maintenance mechanism and special software tools for basic geographic information data and public geographic frame data. The updating of urban large-scale data can be combined with the completion acceptance of construction projects.

3.4.3 Service layer design

The service layer design adopts the basic ideas and methods based on Service-Oriented Architecture (SOA), including three basic roles: service provider, service consumer, and service intermediary:

①Service provider: It is a geographic information service agency that participates in the construction of platforms and provides online services. It is responsible for processing various types of geographic information data resources and establishing and operating various online service systems with standard interfaces.

② Service intermediary: the organization is responsible for the deployment, operation and maintenance of the service registration center and portal website, which is handled by the platform's operation management organization.

③ Service users: developers of various professional systems and ordinary users who call online maps and geographic information services through standard interfaces.

On the other hand, due to the complexity of different users' application of geographic information, traditional offline distribution of geographic information is still indispensable in the service layer in addition to providing online Services in the form of Web Services.

(1) Service layer architecture design.

The data sharing service system is used to provide secondary development application and integration of Web API service interface. The platform-based application middleware realizes the REST-style Web service data sharing service system of all kinds of different spatial geographic data, which mainly provides data-based Web services to the government, municipal departments and counties, realizes the basic spatial data sharing and interoperability, and integrates with municipal departments and county business application systems.

The data sharing service system is composed of a service engine and a data sharing service. It is the core component of the external service of the entire system. Its main function is to directly interact with the data layer, provide system data driving, implement spatial data request scheduling, provide various service for upper-level applications and return data. The data sharing service system is based on the J2EE architecture and uses Web Services mode to provide data services that comply with relevant OGC specifications, as shown in Fig. 4.

① Two-dimensional data engine: ArcGIS Server 10 is used as the two-dimensional data engine. Through service packaging, electronic map data (WMS /WFS) services and information point services are provided externally for network map data sharing and publishing.

② Address encoding engine: Geocode Engine is used in the address encoding data database building and maintenance management system, and provides external address encoding services after secondary encapsulation.

③ Metadata engine: The metadata engine implements database access functions for metadata information of various types of spatial data in the platform database, including query and registration functions. After encapsulation, it provides external space catalog services, metadata query and Registration services (Wang et al. 2018; Li 2011a, b) etc.

(2) Service layer function design.

Geological disaster spatial information is the basis for the establishment of spatial information applications by various commissions and offices. The traditional offline data replication method has many disadvantages such as poor data current situation, lack of unified standard spatial positioning, and complicated update and maintenance. Therefore, the construction of this data sharing service platform will ensure that the basic information of disaster space can be shared safely and effectively from the technical realization level, so as to meet the application needs of various users such as municipal departments. The functional structure of the data sharing service system in the Wenchuan earthquake polar earthquake area (Fig. 4).

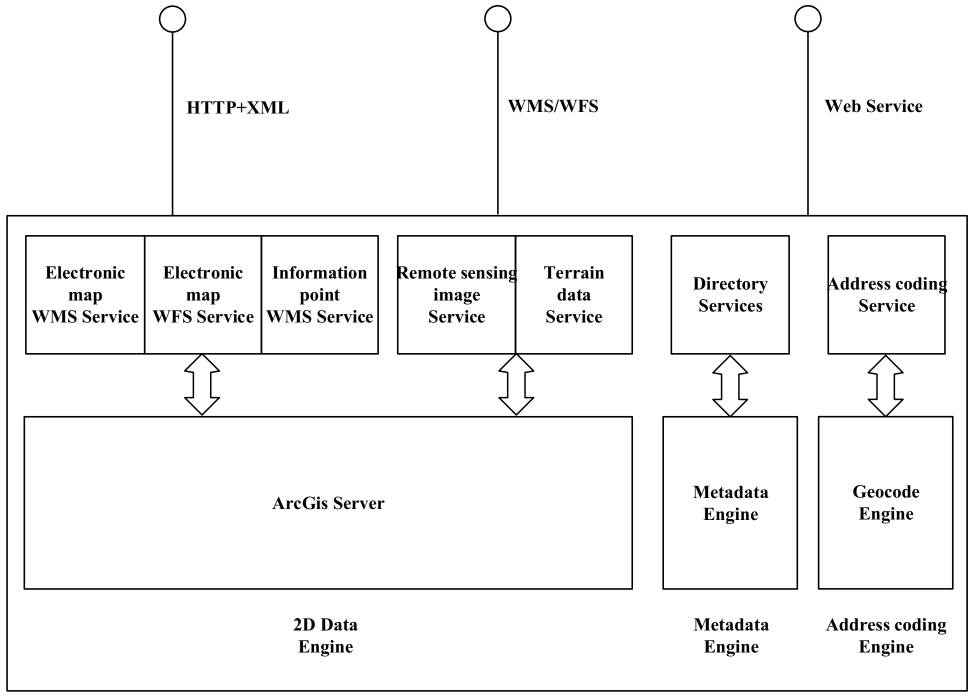

Fig. 4 Gsissm service layer architecture design

3.5 Application layer design

Based on the data and functional service interfaces provided by the geospatial information sharing service platform, it is necessary to establish a professional application system for end business users, and the application integration layer is mainly an information service bus for information sharing and exchange, which is the basis for integrating different application systems.

Through application integration, loosely-coupled connection is formed between different application systems to realize functions such as data transmission, information routing and distribution.

3.6 Standard system layer design

Due to the huge scale of the geological disaster sharing service platform construction project itself, the technical system involved is complex and diverse. On the one hand, the data sources are very extensive, not only including geographic information data, but also various types of data from other industries. The amount of data is complex. It is also required to be compatible with each other and to communicate with each other. On the other hand, the construction of a shared platform must serve multiple levels and types of users, so in the construction of the standard system, it can meet the diverse needs. It is necessary to follow scientific and reasonable guidance and establish a series of mutually supporting standards, specifications, procedures and conventions, focusing on the comprehensive absorption and utilization of existing international, domestic, local, and industry standards, and make the standard theory system a powerful guarantee for the smooth progress of the construction of a shared platform.

4 Shared service interface design of geological disasters

4.1 Interface form

As the provider of the spatial basic information resource service of geological disasters, the platform allows users to call the services provided by the platform through the Web Services API and integrate with their own business applications. Therefore, the interoperability design pattern implemented by API is particularly important. The current design patterns of Web Services are mainly REST and SOAP. REST is simple and easy to use. It follows in the same vein as the Internet. The core idea of REST is resource-sharing and resource-oriented Web services. SOAP, on the other hand, is a widely accepted standard. In terms of interoperability, it has obvious advantages in solving complex system integration. Its core idea is activity-oriented Web Services.

4.1.1 The message flow

The application system sends the service request to the platform application interface service through HTTP GET/POST, and the request parameters are passed through QUERY_STRING in the URL. Here's an example of a request: https://www.host:port/service/RSImage/novo?opt=s

The application interface service responds to the request and sends back the HTTP reply. Depending on the definition of the service interface, the response information may be a document in XML format or a data file such as a map image.

The application interface service returns a HTTP 404 error if the application system request is not within the scope of the platform application interface definition.

Figure 5 is HTTP message flow of the application interface service request reply:

4.1.2 Carrying mode

There are two transport protocols for Web Services: HTTP and HTTPS. The HTTPS protocol is a security protocol that uses encryption for the transmission of information, but it is inefficient, while the HTTP protocol is relatively simple and fast. Therefore, the data resource sharing carrying protocol of the data sharing service platform is HTTP transmission protocol. The request format is HTTP GET and POST, and the response format is XML and map data.

HTTP is a Request/Reply protocol based on Server/Client mode. In the spatial information service interface protocol, the client refers to the application system using the application interface for secondary integration development, while the server refers to the spatial service engine executing the spatial information service.

The security authentication between the platform application interface and the application system can be carried out in two ways. One way is through HTTPBASIC authentication and the other way is through the CA certificate authentication using SSL.

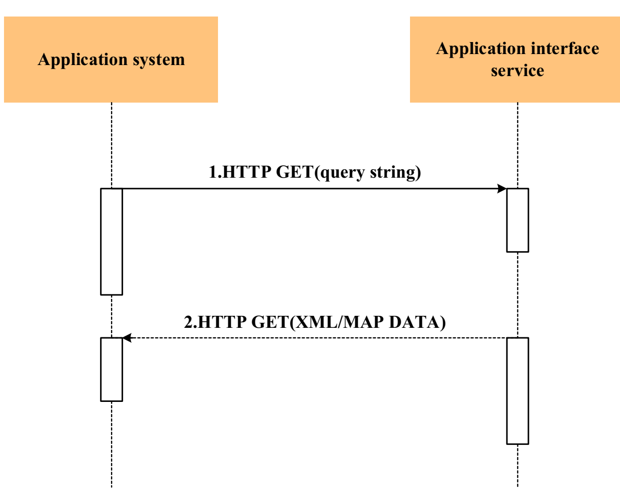

Fig. 5 Flowchart of application interface request response

4.1.3 The structure design

Based on the design principles of standardization, advancement, openness and extensibility of application interface, in order to realize mutual invocation and integration between heterogeneous systems in the Web environment, the platform provides services mainly through the interface way of Web services, as shown in Fig. 6. From the perspective of technical implementation, Web Service can be understood as an application program, which presents to the outside world an application interface that can be called through the Web, allowing it to be called by any platform, any system and programs written in any language. The platform publishes shared resources as Web services, avoiding direct access to the platform database by users and greatly improving the data security of the platform. In addition, the development cost and difficulty are greatly reduced, so that different business applications can use the GIS service provided by the platform by calling the application interface, so as to integrate with the local business application system.

The shared service platform of geological disasters has two kinds of resources: one is data resource and the other is GIS function resource. Therefore, the external service is mainly the sharing and publishing of data and the sharing application of GIS functions.

The basic data of spatial information of geological disasters in the extremely seismic area of the Wenchuan earthquake includes a large number of rich data, such as basic terrain data, remote sensing image data, vector data, spatial metadata and address code, and new data will be constantly supplemented. These data will be shared and published via Web services, providing services that conform to the OGC WMS and WFS specifications, so that departments can easily access the information under license. These GIS functions accomplished through complex application logic belong to the services of the platform functions, such as spatial data processing, production of custom reports and spatial analysis, which previously required in desktop GIS software will be provided to users through the platform in

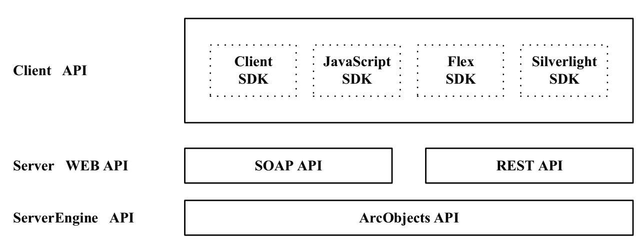

Fig. 6 The hierarchy of application interface

the form of Web Service, so that users without desktop GIS software or tools can also have analysis functions of GIS.

4.1.4 Calling process

The user group of the application interface is mainly those who have requirements of application development. These users call the platform application interface through the application system (including the display system on the platform and the application system of departments directly under city government), as shown in Fig. 7.

After the user is authenticated by the CA authentication and permission verification mechanism (which application interfaces can the user call), and the platform will execute the requested application interface service, and the application interface will send the response result back to the application system client.

The specific process is as follows:

1. when the user logs in the application system, the user needs to provide the username and password, which will be passed to the security system of government administration private network for user CA authentication;
2. If the username and password are authenticated by CA, the username and password information will be passed to the platform operation and maintenance system, and the platform's user and permission verification mechanism will authenticate the user (which application interfaces can the user call);
3. If the permission authentication is passed, the platform returns the successful message and the application interface invocation license is obtained;
4. The application system generates data or function requests based on user operations, and calls the corresponding application interface through HTTP GET protocol or SOAP messages (such as browsing, query, analysis, etc.);
5. The application interface parses the parameters, converts them into the requests of spatial data acquisition or analysis calculation, and passes the requests to the corresponding platform service engine;
6. The platform service engine carries out data acquisition or analysis calculation, and generates calculation results;
7. The platform service engine returns the result data to the application interface;
8. The application interface encapsulates the result data and returns the request result (in the form of XML, text, picture, etc.) to the application system.

4.1.5 The interface definition

The application interface definition is actually the service description file WSDL provided by the platform, which shows the developer what application interfaces are available, how to invoke them, and how service requests and responses are parsed on the client side.

There are two ways to call the services provided by the platform: one is to write the parameters as URL and submit them to the server via GET, which is the usual way to the calling of REST API. The other is to encapsulate the request command as XML and submit it in the POST method, which is typically used for the calling of SOAP API.

Raster maps are often obtained by the GET method, such as: https://wms.jpl.nasa.gov/wms.cgi?&VERSION=1.1.1&REQUEST=GetMap&STYLES=&LAYER

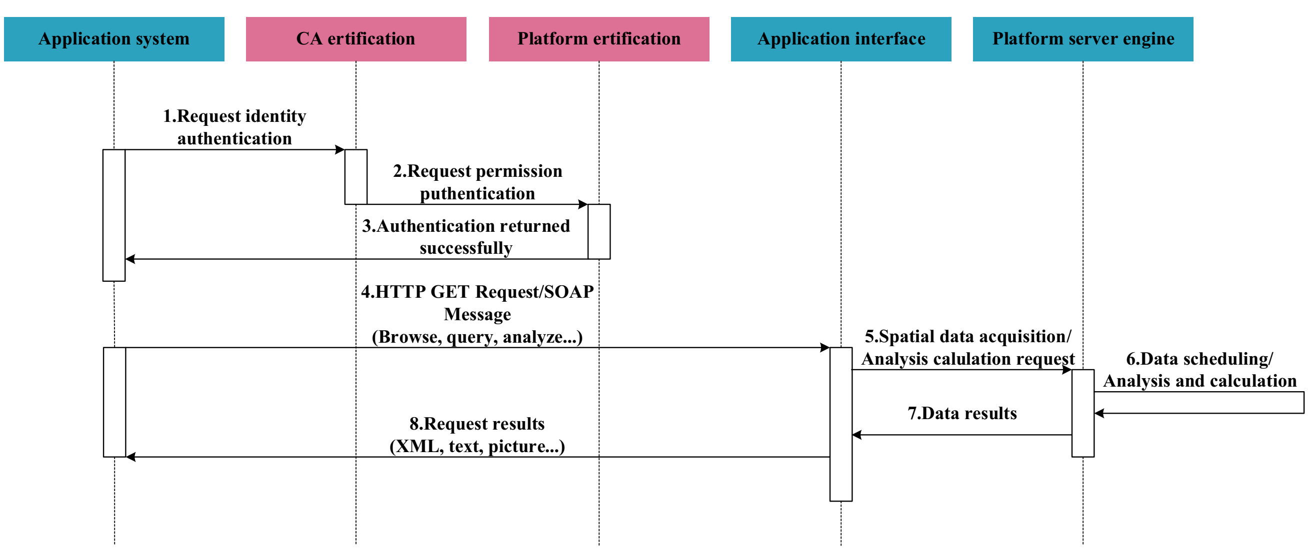

Fig. 7 The calling process of application interface

S=global_mosaic&FORMAT=image/png&SRS=EPSG:4326&BBOX=73,18,135,53&width=800&height=456

The above call represents a mapping service request to JPL (Jet Propulsion Laboratory) using the WGS84 coordinate system between 28°51′–33°06′ north latitude and 101°33′–108°22′ east longitude. The map output format containing the layer of "global_mosaic" is PNG with a size of 800 × 456.

The complex WFS call encapsulates the service request into an XML format, submits it by POST, and returns GML results that use XPATH and XSLT technology to separate the geographic coordinates and attribute information of the entity, and finally draws the entity on the map to represent the attribute in the form of a list.

4.1.6 Interface implementation

Data sharing service platform provides services including access service of remote sensing image data, the service of two-dimensional vector data, information service (POI), address coding, metadata directory service, data elevation model service (DEM), etc., which are provided to users to use through the HTTP protocol as REST API application interfaces, while some services such as spatial processing analysis will be available to the public in the form of SOAP API based on the SOAP protocol, as shown in Fig. 8.

5 Conclusions

The paper is suggested to establish a sound standard system and policy system for spatial information sharing of geological disasters. Realize the standardization and institutionalization of the whole process of production, collection, processing, database building, release, sharing and exchange, service aggregation of basic data and business data of geological disasters, and basically establish a long-term mechanism of spatial geographic information sharing of geological disasters.

This article applies GeoWeb 3.0 to geo-hazard evaluation management, which uses service-oriented evaluation to evaluate during the geo-hazard evaluation procedure. Thus, the sharing of business is realized. So, it is not the data sharing mode any more, breaking away from the traditional shared-mode of C/S or B/S structure in departments. Meanwhile industrial departments from all walks of life can gain the geo-hazard data rapidly and use them effectively via geo-hazard sharing services platform. Therefore, the jointed information services for government offered by different industrial departments is achieved, making the decisions made by government more objective. At the same time, it can also provide much more convenience for the public in the daily life.

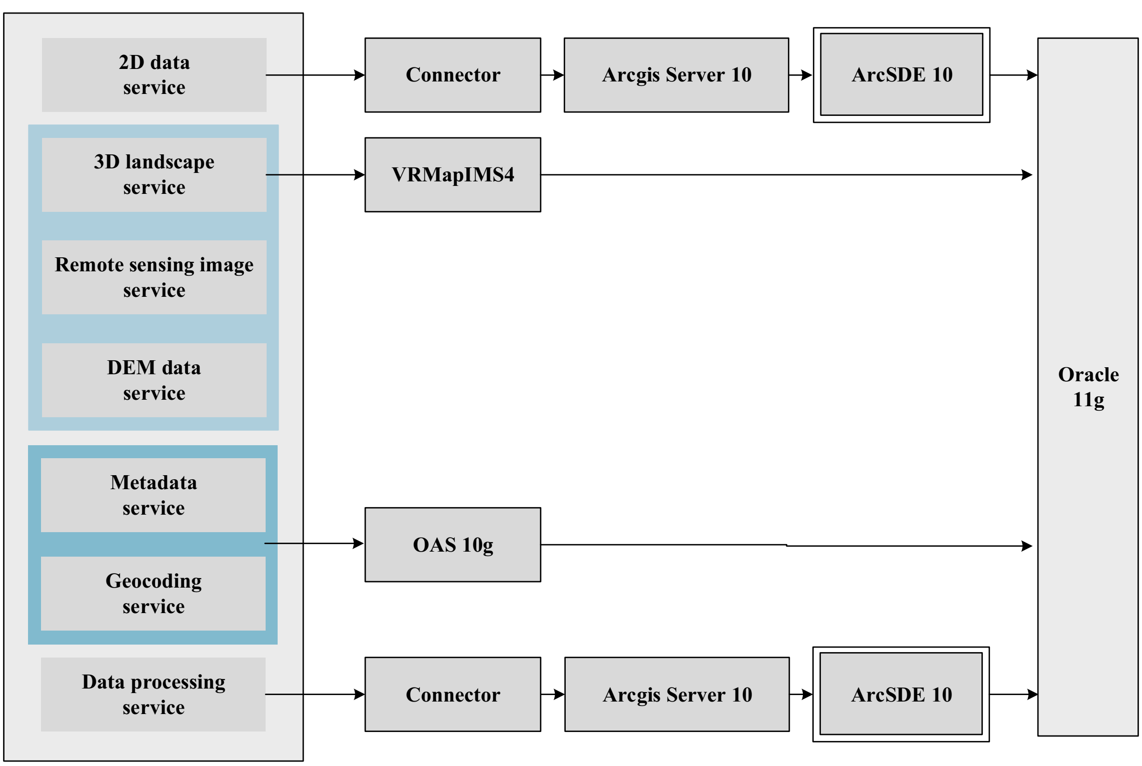

Fig. 8 Schematic diagram of application service interface

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