

A Novel Power Supplies Network Method Based on Topology Logic Model

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Abstract—With the implementation of smart grids, grid power information technology is becoming leaner. In the past, due to the lack of systematic thinking, the management of the distribution network was inefficient. This paper is based on the automatic generation technology of low-voltage station area based on graphic layout and topology service, and proposes solutions for the complicated equipment in the low-voltage station area. Efficient self-checking of a single topology relationship created by the simulation or the entire topology network can be completed to ensure data consistency, security and accuracy.

Keywords—graphic, automatic generation, topology network, self-checking

I. INTRODUCTION

In the past, in terms of distribution network management, due to the lack of overall and systematic thinking, the distribution network has not been able to achieve overall and efficient management in power grid. Each professional condition is based on its own management habits to analyze and respond to problems, and the management level is always difficult to achieve systematic improvement. With the implementation of intelligent grid and the promotion of "two-center system", power industry management has become increasingly flat and lean under the support of information technology.

To realize the management idea of "distribution of one network", the network-wide power supply topology logic mode is the key to research. Distribution network of "three figures", including single line charts, network diagrams and GIS (Geographic Information System) map. The figure contains basic information about static attributes, topological relationships, and measurement data of the distribution network equipment. Through the construction of "first-class distribution network", the current data base of battalion adjustment has been completed, and the grid space information platform, massive real-time data platform and master data management platform have been completed and put into operation.

However, it is still weak in terms of data applications and visual presentation. The following problems exist:

- 1) The sharing of data in the presentation layer has not been completed.
- 2) Since GIS is a platform-level application, it only contains basic device information.
- 3) The linkage of the three maps is not complete. Only the GIS map and the network map can be generated from the single line graph. It is impossible to dynamically generate the one-line graph from the GIS map or the network graph.
- 4) Currently using the network diagram.
- 5) The power grid infrastructure is not tiered.
- 6) The analysis based on "Big Data" has just started, and there is a lack of monitoring and analysis of real-time conditions of distribution networks based on "one map" of power distribution.

Literature [1] proposes a scheme for constructing a general model of distribution network topology analysis based on common information model (CIM). Literature [2] proposed an imaging algorithm based on topological layering. Literature [3] proposes a topology automatic identification scheme, in which each intelligent terminal manages a local topology. The literature [4-5] divides the topology analysis process into two parts: static topology and dynamic topology. The basis of the subsequent dynamic topology is formed in the static topology analysis process.

This paper proposes a new distribution network management model based on the "distribution network" distribution network management idea and the goal of customer-oriented and reliability. "Power distribution a network" refers to not a physical network shelf. At the physical network level, the distribution network itself is one. The "Power Distribution Network" in this paper is aimed at the business model and system architecture level, emphasizing the convergence of the camping and end-end services under the support of information technology. In this paper, spatial data grid platform, the massive data platform, based on the master data platform, to create holographic information distribution network in "three graphics linkage" integration and application-based, grid operators to build distribution analysis command center decision-making.

II. SYSTEM STRUCTURE

Based on the multi-dimensional information-based network distribution failure judgment method, the business process of the distribution network repair command is optimized, and the business model of data sharing among multiple departments is re-established [6]. This paper takes the distribution network equipment and its grouping as the object, and integrates the various results of the data resources of the core business of the distribution network to interactively connect the business results of different levels, so as to spread the information and scattered business of the distribution network in the past. Conducting a comprehensive integration, reshape the information system-based operations and management behaviors with a flattened idea, and build a graphical and visual “distribution network” to form information penetration and panoramic analysis targeting devices and their grouping. To realize the multi-functional “business layer”, to change the work layer of the past system, management business mix, function point dispersion, weak correlation, etc., to realize the graphic public service center based on the whole network power supply topology logic model, and to make " The “distribution of one network” panoramic view has become an effective resource support and decision support for distribution network management, and has become the basis for the innovation of “distribution network” system.

Establish a scalable software framework model, extract the common service requirements of each business application system, formulate a unified service I/O interface standard based on the CIM model, and form a public graphics service component pool based on the enterprise-level graphical component service development method to achieve public "Plug and Play" for graphics services. By evaluating various NoSQL databases and distributed computing technologies, Mongo+Hadoop technology is selected. The data structure supported by MongoDB is very loose. It is a JSON-like BSON format, which stores data in the form of key-value pairs and can store complex type of data[7].

III. PREPARE YOUR PAPER BEFORE STYLING

The components are independently supported and can be coordinated with each other. The overall architecture of the image file application based on the network-wide power supply topology logic model has a high degree of automation of topology information management. It can meet the needs of the network topology information of the intelligent distribution network automation system [8]. The body architecture is shown in Figure 1:

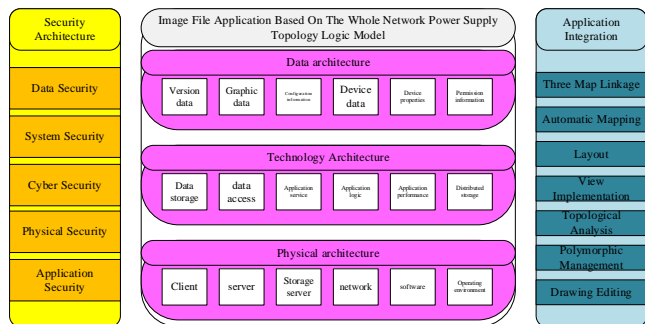


Figure 1 Whole network power supply topology logic model system architecture diagram

The data architecture defines the data model, data classification, and deployment method in the image file application based on the network-wide power supply topology logic model. The physical architecture is a platform that provides hardware and software support for upper-layer applications. The design of the physical architecture needs to focus on the high reliability and high efficiency of the spatial information service platform to achieve the purpose of efficient and stable operation of the system. The advantages of this architecture:

A. Scalability

By adopting a scalable software framework, the system has developed a standard input/output standard format, which implements the loose coupling applied to the algorithm and reduces the impact of algorithm changes on the upper application. At the same time, the system supports multi-system data sharing and service integration. By extracting public services, the repeated development of the same application service is reduced, saving a lot of manpower and material resources.

B. Distributed storage and processing

The Mongo database is used to establish a distributed storage mechanism for large data volume grid data. Its persistence feature protects the data in the cache and avoids system abrupt interruption, which causes all data in the cache to be lost [9]. At the same time, the Hadoop architecture is adopted to realize distributed processing of graphics data and improve the mapping efficiency of the network graph.

C. Three map linkage update

By providing an external service interface, real-time switching and displacement information of the system such as distribution automation can be integrated, and the real-time update function of the corresponding network diagram and single-line diagram can be completed. It also supports the update of network diagrams and one-line diagrams caused by device update.

D. No relationship with system and platform

Through the clustering and packaging design of various service components, the input/output standard format of the interface is developed, and the functional service calls of various business systems are supported to form a public grid service center to efficiently support the graphics of the business systems of the grid application function.

IV. KEY TECHNOLOGY

A. Breadth-first fast network topology technology based on real-time switching action

Network topology refers to the specific physical connections between members that make up a network, meaning a true arrangement. If the connection structure of the two networks is the same, we say that their network topology is the same, although their respective internal physical wiring and inter-node distance may be different.

B. Based on scalable software framework and component design

Due to the variety of graphics applications and mapping

layout algorithms, and with the deepening of technology and business applications, the original algorithms need to be adjusted. Therefore, the design of scalability requirements requires a flexible and scalable software framework to meet the needs of development. By extracting the public needs of various business departments of the grid, the input/output interface standards are defined, and the various algorithms are highly abstracted and the base classes are packaged into various component groups in a component-based development manner to provide various business application system calls. This mechanism can be used to shield the influence of the change of the algorithm component model on the upper-layer business application, realize the loose coupling between the application function and the component, and improve the reusability of the business application.

C. Data processing mechanism of power grid thematic map based on MONGDB+HADOOP distributed storage and calculation

Mongo DB is a non-relational database (NoSql) based on distributed file storage, written in C++. Each record in Mongo DB is a Document object. MongoDB is the product of the development of big data. As the amount of data increases, the access performance can be guaranteed by horizontal expansion.

The utility model of the whole network power supply topology logic model is the pioneer of the exploration of the Yangzhou model service center in the future. The types of graphic image data managed are large and large, and the centralized data deployment is very stressful on the network. Therefore, the data of MONGDB+HADOOP is decided. Distributed deployment and distributed computing reduce the amount of data transmitted by the network, share the pressure of single-server computing, and improve system operation efficiency and availability.

The data distribution technology using MONGDB HADOOP can bring the following advantages:

- High expansion: Allocate data between available computer clusters and complete computing tasks. These clusters can be easily extended to thousands of nodes to improve computing efficiency and improve system response speed.
- High efficiency: MongoDB with built-in GridFS can meet the fast range query of large data sets.
- High performance: server computing pressure sharing, reducing server performance requirements.
- High Fault Tolerance: Ability to automatically save multiple copies of data and automatically redistribute failed tasks.

The MONGODB technical architecture is shown in Figure 2:

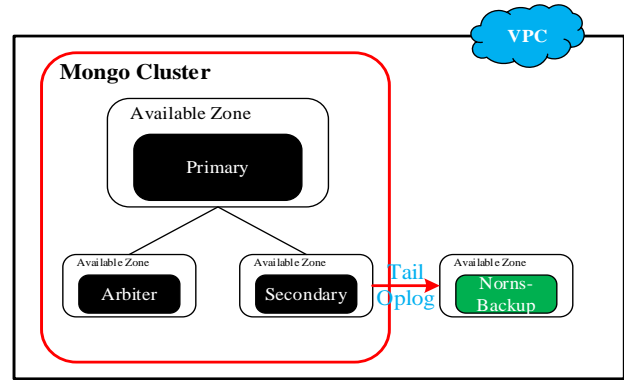


Figure 2 Mongo technical architecture diagram

V. TECHNICAL ARCHITECTURE

The whole network power supply topology logic model practical technology project makes breakthrough research on the display effect of the thematic map and the mapping efficiency. Therefore, the platform adopts the big data storage architecture of MongoDB+Hadoop+HBASE as the support.

The practical technical architecture of the whole network power supply topology logic model is shown in Figure 3:

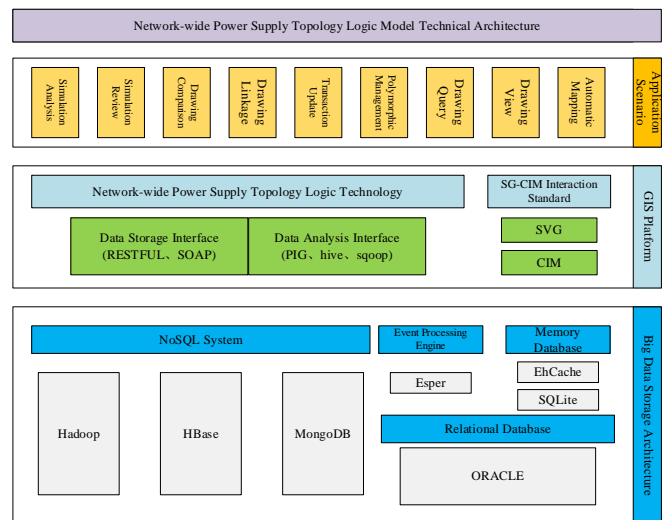


Figure 3 Whole network power supply topology logic model practical technology architecture

The utility model of the whole network power supply topology logic model is described in three parts according to the involved system, technical standards, architecture and other factors:

- Application scenario

The application scenario is the top-level application, which is intuitive and visually presented to the user's specific application. It covers the production, layout, viewing, updating, editing and deletion of a complete set of drawing management processes from drawings, which provides access to business and data of external systems, and can also form a system independently.

- GIS platform

The GIS platform bears the responsibility of data

generation, distribution, and delivery of messages throughout the architecture. In the process of transmitting data, the data expansion and cross-platform are fully considered. Therefore, the SG-CIM model of the national network standard is adopted as the data bearer. The project finally establishes a set of standard public graphics services. At present, the GIS platform serves as a platform for the State Grid Corporation to uniformly construct and manage grid resource data. Therefore, it needs to be used as the data source of this project and carry out corresponding technical verification work.

- Big data storage architecture

Mainly using distributed number architecture storage and deployment, Hadoop is the mainstream architecture for distributed data architecture and analysis based on big data. It is the mainstream architecture, cross-platform, secure and efficient. Hive is an important data warehouse tool in Hadoop, and Hive greatly reduces the learning cost of Hadoop.

VI. CONCLUSION

This paper proposes a graph-based layout and topology logic technology that can perform a single topology relationship created by simulation or an efficient self-checking of the entire topology network, which can simplify the management of the station area, ensure data consistency, security and accuracy. The complete topological relationship network can effectively ensure the accuracy of the mapping

and the relationship between the simulated power transmission, and can ensure the fast and beautiful picture.

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