Research on Data Management of Power Grid Enterprises Based on Data Middle Platform

Qifan Yang¹, Yuxiang Cai¹, Liang Shen²*, Xiangzhou Chen², Liang Lan³ and Xin Jiang¹

¹Information and Communication Branch of State Grid Fujian Electric Power Co., LTD, Fujian, 350000, China
²Big Data Center, State Grid Corporation of China, Xicheng District, Beijing, 100031, China
³State Grid Information and Communication Industry Group Co., Ltd., Changping District, Beijing, 102200, China

*Corresponding author e-mail: shenliang@epri.sgcc.com.cn

Abstract. At present, the construction process of power grid enterprise information system mainly adopts the "vertical integration" system structure, with high construction cost, long period, non-sharing of data and low quality. By introducing the concept of data middle platform to reaggregate and reconstruct unified supervision of enterprise data, it provides accurate and reliable, shareable and reusable data application services with business logic for front-end business, and realizes intelligent interconnection and data sharing in all aspects of power system. This paper puts forward the idea of data center, and puts forward data management methods from master data, data warehouse and metadata management respectively, so as to provide data service support for the development of power grid business towards intelligent and efficient direction.

1. Introduction
The current information construction of power grid enterprises mainly adopts traditional concepts to build big data platforms. Each business system mainly adopts the "vertical integration" architecture [1]. Each system has its own equipment and management methods, resulting in high maintenance costs, difficult reuse, non-shared resources, low data quality. How to get through these data and build them in accordance with the unified standard, so as to achieve the goal of technology cost reduction, application efficiency improvement and business empowerment, is an important problem faced by power grid enterprises [2].

The data middle platform is to realize the common data capability through the stratification and horizontal decoupling of data, separate the data operation and product technical force from the front desk, establish an independent middle platform, and realize the sharing of business capability through service reuse [3, 4]. Compared with the traditional information construction method, the vertical integration architecture is eliminated, and the contradiction between the background with a relatively slow change cycle driven by innovation is solved. It introduces the concept of data middle platform, integrates and reconstructs enterprise data, provides accurate and reliable, shareable and reusable data...
application services with business logic for the front-end business, and provides construction strategies for realizing intelligent interconnection and data sharing in each link of the power system [5].

2. The idea of data asset management based on data middle platform.

The core idea of data asset management based on data middle platform is to manage data objects as a new form of assets [6]. Its goal is to break down the gap between data and to build the foundation of enterprise data middle platform. The data asset management construction framework based on data middle platform is shown in Figure 1.

![Figure 1. Data management construction framework based on data middle platform.](image)

1) According to the current existing system source data, the source-end data integration is realized through master data management, a data warehouse is established for light summary, and the entire amount is copied to the enterprise data warehouse through data integration. After cleaning and conversion, the warehouse data model is used to integrate multi-source data, realizing financial sharing and accessing the original system data for supplement and verification.

2) After data collection is completed, logical integration based on metadata management is adopted to realize data application sharing, and metadata management of source system data can also be carried out directly to realize logical integration management.

3. Source-end data integration method based on master data

Master data is the core business data of an enterprise and the key to data connection and fusion between different systems. Although a unified master data platform has been built in power enterprises at present, master data is still maintained and used separately by professional parts, and no enterprise-level standard has been formed.

Master data will be identified and separated from each business system database and incorporated into the business owner data platform [7]. Maintenance and management will be carried out based on the unified data model. The maintenance, management and use rights of each field in the master data table will be authenticated and shared to each business system for use through the distribution mechanism. Each business system carries out functional transformation. By integrating relevant functions of master data platform, it maintains master data within its own scope of responsibility and degenerates itself into a simple transaction recording system. Master data is not stored redundantly in each system database. The source-end data integration construction strategy based on master data is as follows.

1) Establish enterprise data model standards. The classification framework and catalog index of master data of power grid enterprises are established. The data structure and basic information of each master data are sorted out one by one according to the actual data of each information system, and the data model standard of power grid enterprises is formulated.
2) Improve master data platform. The master data in each information system is identified. The business, management and technical attributes of each master data are sorted out one by one. The business source, maintenance and access rights of each data item are determined, and the master data ledger is established. The master data platform functions have been improved to provide master data management integration services and replace the ledger maintenance functions in various professional systems.

3) Establish data management mechanism

The working mechanism of data management is built synchronously, and the data management support platform of power enterprises is built. Data indicators, master data ledger, data sharing, data quality, data security and so on are implemented unified management.

4. Data aggregation, management and application based on enterprise data warehouse

The foundation of data warehouse construction is the enterprise-level data warehouse model, which generally adopts topic-oriented or dimensional data model to reconstruct enterprise data. The integration of multi-source heterogeneous data is the key to the success of enterprise database construction [8]. The architecture design of using warehouse data model to integrate multi-source data is shown in Figure 2.

![Figure 2. Data aggregation, management and application framework design](image)

1) Build a data warehouse model According to the enterprise data architecture, the enterprise data warehouse model is built by using the normal form modeling method. Data model verification is carried out to map business data entities and data warehouse models, and verify business data information compliance and business process coverage. [9] The data warehouse model design is carried out and the physical data warehouse is created. This provides a "container" carrier for centralized storage and query of structured data, real-time data, unstructured and external data, and logically solves the problem of inconsistent data models between systems and difficulties in cross-disciplinary data application.

2) Multi-source data integration. The scattered and inconsistent data in the business systems at the source end are reorganized according to the subject area, and the inconsistencies in the source data are eliminated by means of data extraction, cleaning, transformation, summarizing and sorting, so as to ensure that the information in the data warehouse is consistent and global information about the whole enterprise.

3) Provide data operation services. A long-term mechanism to ensure the continuous operation of the enterprise data warehouse has been formulated to support the scientific operation of the enterprise data warehouse from the dimensions of organization, system, process, manpower, technology, etc., continue
to expand the scope of data access, and continue to improve the support of data sharing services and analysis applications ability.

5. Logical integration and sharing applications based on metadata management

Metadata is essentially the definition of data, describing the structure, connotation, and characteristics of the data. It can express information such as data, association relationships between data, data and business correspondence, data processing logic, etc., and is used to describe enterprise data integration logic [10].

The logic integration and shared application construction strategy based on metadata management is as follows.

1) Establish a data management system. The status quo of the existing data resources of the enterprise is cleared, metadata is collected, and a data management system is established synchronously, including the establishment of a unified data resource target index for the enterprise, sorting out data standards and specifications, carrying out data inventory, formulating a normalized data management system, and building a unified data management platform.

2) Continuous maintenance and management. Ensuring the continuous operation of the enterprise data management system is the focus of construction, which specifically includes building a unified view of enterprise-level data, carrying out source-end data resource monitoring, verifying and managing data quality issues, conducting metadata comparison and maintenance, and establishing source-end data change mechanism in combination with informatization processes and implementation of data life cycle management, etc.

3) Provide data sharing application services. By sorting out the list of enterprise level data sharing directory, carrying out hierarchical management of internal and external data resource sharing, researching and breaking through ubiquitous data access and security control technology, building data sharing ubiquitous service platform, accepting and processing data sharing open requests, etc., provide unified data sharing access service for business applications.

6. Conclusion

Through the establishment of the idea of data center and the application of three data management methods on this basis, it is conducive to the realization of data sharing among power grid enterprises, and provides a solid foundation for the future innovative and efficient development of power grid enterprises.

Acknowledgments

This work was financially supported by Science and Technology Project of SGCC (Research on key technology of data center design and realization) (SGFJXT00WLJS1900278).

References

[1] Ji Chunhua, Hao Han, Wang Yanlei. Research based on Oracle database integration technology [J]. Information technology and informatization, 2018 (11): 95-101.
[2] Wang Fei, Xin Haisong, Hu Lijuan, et al. Development of data quality improvement and data recovery system in distribution network [J]. Power System and Clean Energy, 2019, 35(3): 58-61.
[3] Gao Guowei. "Cloud Inspiration" from Alibaba's technology center [J]. Project management review, 2018(2): 26-27.
[4] Zhu Hongpu. Build enterprise data center and promote enterprise intelligent operation data middle platform [J]. Communication enterprise management, 2018(2): 32-33.
[5] Jiang Xudong, ZHOU Xiaozheng, FANG Ling, et al. Customer analysis system for power supply based on data warehouse [J]. Guangdong Electric Power, 2007, 20(12): 30-33.
[6] Li Li, Hua Kui, Jiang Yunpeng, et al. Research review on key technology for multi-source heterogeneous data processing for transmission lines [J]. Guangdong Electric Power, 2018,
31(8): 124-133.

[7] CLEVEN A, WORTMANN F. Uncovering four strategies to approach master data management [C]// Hawaii International Conference on System Sciences, Honolulu, HI, USA, 2010: 1-10.

[8] DAHIYA N, SANGWAN N, BHATNAGAR V, et al. An experiment towards metrics validation for data warehouse conceptual models [C]// 2014 5th International Conference-Confluence the Next Generation Information Technology Summit, Noida, India, 2014: 116-123.

[9] Zhang Rui. Based on the Hive of data warehouse logistics research and design of the big data platform [J]. Electronic Design Engineering, 2017, 25(9): 31-35.

[10] Shi Yanbin, Su Gengshu, Li Ling, et al. Study on uniform resource model design method based on major class and metadata [J]. Telecommunications Science, 2015, 31(2): 132-140.