

# The Design of Electricity Sale Company Platform Based on “Internet Plus”

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**Abstract:** With the development of big data, cloud computing, Internet of Things, "Internet +" launched a new round of revolution in the industry. With the release of the Power reform document 9 and a series of supporting documents, the China's power reform gets a new opportunity. In the sale side of power reforms, the electricity sale company plays an important role. Combining with “Internet +”, big data technology and the successful mode of foreign electricity sale companies, we design an operation platform for electricity sale company. This paper has a certain reference value for operating the electricity sale company.

## 1. Introduction

With the continuous development of information technology, "Internet +" becomes a new economic form. In order to encourage the further promotion of "Internet +", the government launched a serious plans [1]. At present, "Internet +" has become the symbol of deep integration between industry and informationization in China.

The launch of [2] marks the latest round of power system reform. In order to continue to promote the steady progress of power reform, the NDRC and the Energy Bureau jointly together to issue a series of supporting documents [3-8]. Sell side reform will become the breakthrough of the power reform. Power reform will officially enter into the deep water.

In the process of the sale side reform, the electricity sale company plays a major role. For the sale company business model, there is no domestic mature experience. For the construction of the electricity sale platform, there is no uniform standard, either. In this paper, based on "Internet +" and big data technology and combined with foreign electricity sale company's mature business model, we design the operation platform for the electricity sales company.

The main contributions of this paper are as follows:

1). Analyze and summarize the mature operation mode of the overseas electricity sale company.

The electricity sale company is a service window to provide electricity to end users. Overseas electricity sale company, after many years of development, has undergone many different stages. After market inspection, the electricity sale company has produced a series of operation modes. We summarize the distinctive patterns and use the mature operating model directly to avoid exploring detours.

2). Research on open source for big data technology.

At present, big data technology has become a hot term, which has risen to the national strategy. Our research on major open source data processes technology, which is better for the subsequent platform design.

3). Based on big data technology and "Internet +", combined with the electric company business model to design the electricity sales platform.

Based on open source for big data technology and ‘Internet +’, we design the sales platform from the functional level and the technical level respectively. In the operative level, the design is carried out based on the general business model. In the nominal level, the design is based on Apache big data open source products. Using open source products to design the platform can avoid the

disadvantages of firm-level data products which just to emphasize a function and allow people to understand the platform from a more comprehensive perspective. In addition, a platform built on open source products can be better design and has more flexibility.

The structure of this paper is reproduced below. The first chapter mainly introduces the business model of overseas sales companies. The second chapter introduces the designs of the platform from functional and technical level respectively. Finally, we summarize the article.

## **2. Business model of overseas electricity sale company**

Electric sales companies in foreign countries have been operating for many years. The electric sales companies, which experienced the market and the user's inspection, have a series of mature operation mode. In this chapter, we mainly introduce and summarize the business models in typical countries.

### **2.1 United Kingdom**

British power reform began in the 1990s. After more than 20 years of mergers, acquisition, restructure and reform, a more mature market system has been formed. The current electricity market in the UK has four parts: power generation companies, transmission companies, distribution companies and sale companies [9-11]. In the course of electricity trading, the power generation company makes profits by selling directly to embedded users and power sale companies. The power sale company gains profit by telling the difference between the power generation companies and end-user. Transmission and distribution companies through collect the Internet fees and networking fees to obtain profits [10-15].

The early operation mode of the electricity sale company is relatively simple, and the charge mode is minimal too. The selling price includes a fixed charge and unit electricity charge. Whether or not they use electricity, they charge a fixed fee. The unit charge rate is charged according to the actual use of the electricity. With the increasing number of sales companies, the competition has been rising. In order to attract users, each company has formulated a series of packages according to different situations.

### **2.2 Germany**

In Germany, electric sale companies not only support the traditional operating model between the electricity market and the user, but also support the development of new energy. In 2000, Germany enacted the Renewable Energy Act, allowing different energy sources such as photovoltaic and wind power to participate in electricity trading. At the same time, Germany provides high feed-in tariffs for fresh energy and encourages the development of distributed energy. Behind this background, the "people's commune" on the electricity sale side appeared in Germany. The ordinary people in Germany set up cooperatives. They spontaneously raise funds to set up new energy power plants, such as wind power or light energy, according to local conditions. The electricity generated by the power plant is used to meet the production and living needs of the neighborhood residents, and the extra power is sold online. In this way, it not just responds to the needs of local users but investors can profit by dividend, which is very attractive to the public investors.

### **2.3 United States**

In United States, the power sales company and Internet company are linked closely. The Internet plays a major role in the production and sales of electricity. Using the Internet can help ordinary users to save energy, and help traditional power generation enterprises to upgrade their transformation. Opower is such a high-tech company. Opower acquires an end user's data by working with traditional power generation companies. Based on the cloud platform, using the weather information, age information, behavioral science theory and user's consumption record, and so on, Opower can provide users with energy-saving proposal. After years of promotion, Opower

has developed into a multinational company and contracted with companies in many countries worldwide to provide energy saving services.

Through what have mentioned above, it can be found that the service mode of electrical sales company can be divided into following models:

1. Simple mode

In early stages of the electricity sales market, the competition is not intense, so the operational model is relatively simple. In this model, the sale price is simply defined without considering the user's actual need.

2. Extensive mode

With the increasing number of electricity sales companies, competition continues to intensify. In order to attract users, the company sets up a series of packages for discrete time, user groups, and settlement methods.

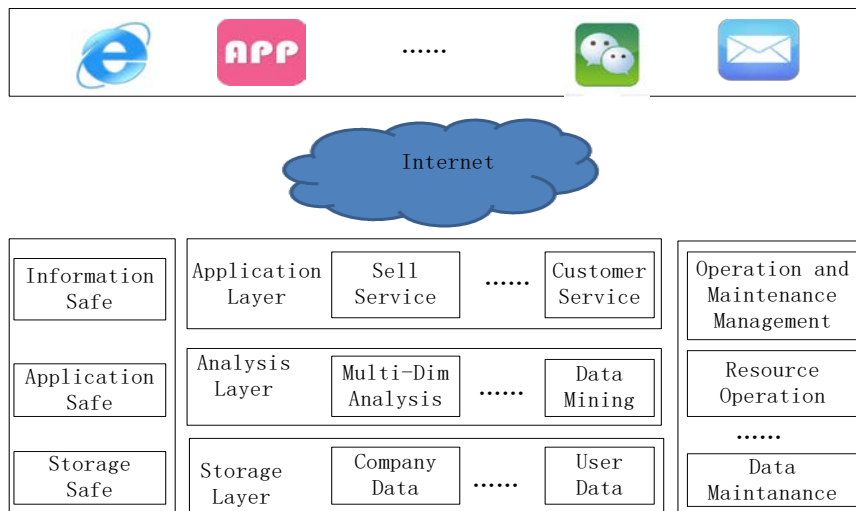
3. Fine mode

In this mode, the sale of electricity companies makes full use of "Internet +" and big data technology, to obtain a variety of user data, and then combined with big data analysis and mining technology to provide users with customized solutions.

**3. Sell electric company operation platform**

In this chapter, we introduce the operation platform from the functional and technical level respectively. On the literal level, the platform design is mainly based on Apache open source products. In the design process of the absorbing company, we mainly consider the fine mode.

**3.1 Functional designs**



**Fig.1 Platform for Electricity Sale Company**

As showed in Figure 1, the platform of the electricity sales company is divided into storage layer, analysis layer, application service layer, operation and maintenance management layer and information security layer. Each layer has a clear division and cooperation to ensure the normal operation of the company.

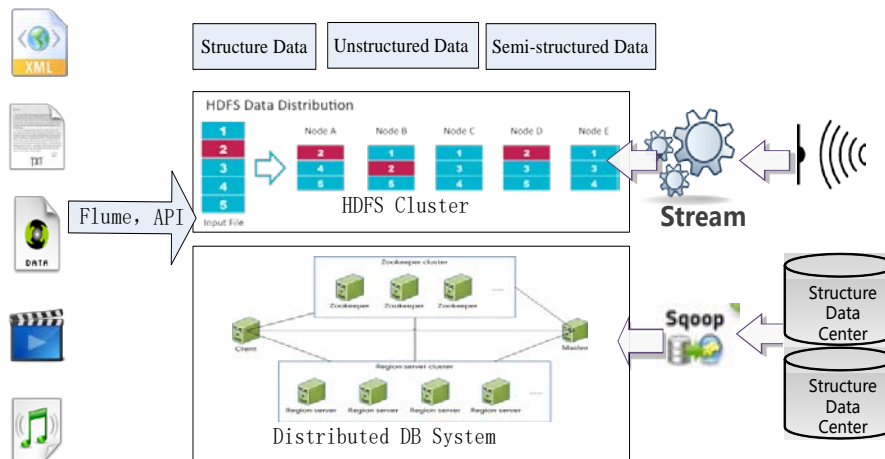


Fig.2 Data Storage Layer

### 3.1.1. Data storage layer

The data storage layer stores data, which is needed in the upper layer. In data storage layer, according to separate data types, the data can be divided into structured data, unstructured data and semi-structured data. Structured data mainly refer to data stored in traditional relational database systems, including human data, financial data and other related data. Unstructured data mainly refer to text data, image data, voice data and video data. Semi-structured data mainly refer to XML documents and other related data. For structured data, the customary approach is mainly stored in the relational database system. The common used relational database system is SQL Server database system, Oracle database system, MySQL database system, etc. In order to cope with big data, the traditional structured data, which stored in data center, will extract to distributed database system or HDFS cluster through Sqoop. For unstructured data, it is extracted through Flume and additional tools into the HDFS cluster.

The data storage layer mainly store industry data, power plant data, user data and operational data, etc. Industry data refer to the dynamic information related to electricity, coal, oil, natural gas and renewable energy. Using the data, it is convenient for users to make online inquiries and learn about industry trends in real-time. At the same time, for the electricity sale company, it can adjust their sale price accordance with real time data. The power plant data, mainly refer to the different power plant price data. The user data include direct access electricity users data, end users and power transactions related data. Operational data mainly refer to the data needed for the normal operation of the platform, including financial, human and other related information. In addition, the corresponding data information can be stored depending on the needs of the upper layer business.

### 3.1.2. Data analysis layer

The data analysis layer is mainly to calculate and analyze the data to provide services for the application service layer. In data computing, according to the way of data arrival and processing characteristics, it can be separated into streaming computing, distributed computing, memory computing and traditional offline computing.

Streaming Computing mainly deals with streaming data generated by sensors and other data sources. There are for two main approaches to deal with streaming data. The basic approach is to store the data first and then process the data. After the data arrives, the data is stored in the data storage layer according to the data type, and then the corresponding data are extracted according to the requirement. The second way is to process the data first and then store the results. In Streaming Computing, data is collected through the Kafka allocated message queue, and then processed by the Storm stream processing framework or the Spark processing framework.

Memory computing is tantamount to process all the data in main memory. the development of hardware technology, the memory price is decreasing and the volume is increasing, making it possible to process large-scale data in main memory. In memory computation, the Spark memory computing framework is used for real time statistical analysis and interactive analysis.

Distributed computing and offline computing, according to the characteristics of business applications, can be processed with the customary Map-reduce batch model.

### 3.1.3. Application service and Operation management layer

The application service layer mainly uses file services, data services and analytical services to provide related services to users based on Webservice and visualization demonstration.

Operative management is mainly to maintain the normal operation of the platform. It includes: the collection, storage and resource monitoring. Hardware indexes and software running status of the monitoring platform play an important role in the whole system.

## 3.2 Technology Design

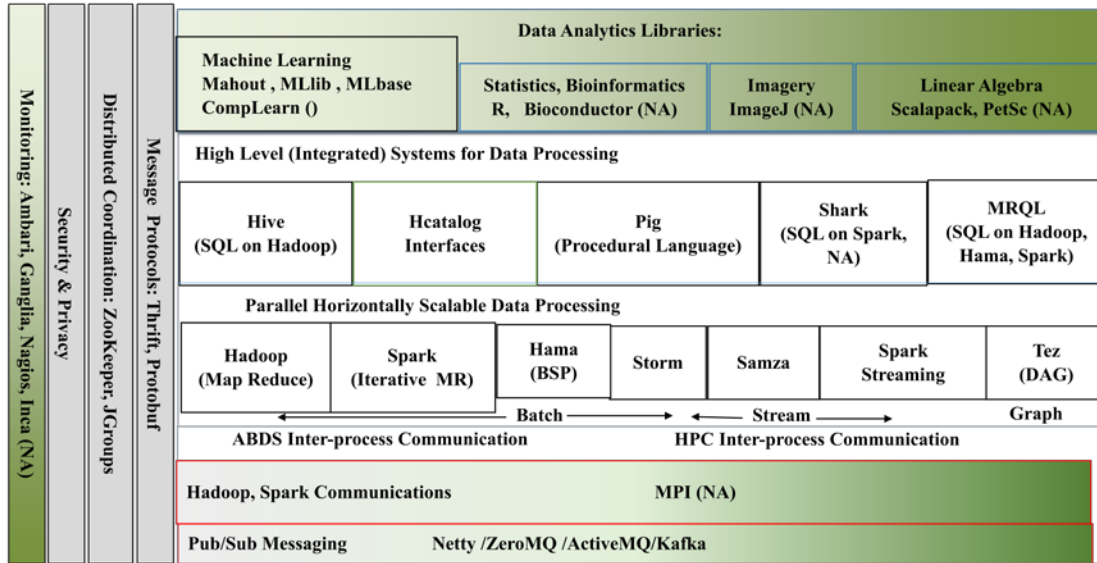


Fig 3 Platform for Electricity Sale Company

This section focuses on the platform design using Apache open source big data processing software, as showed in figure 3.

### 3.2.1. Data storage layer

The structured data and unstructured data, which needed at the upper level, will be collected by Kafka, Netty and ActiveMQ. For the collected data, it will be saved in a Hadoop cluster and distributed database system.

Kafka is a high-throughput distributed publish subscribe message system, which support Hadoop parallel data load. Kafka has high-throughput characteristics. Kafka is a high throughput distributed messaging system that supports Hadoop parallel data loading with high throughput features. Netty can provide asynchronous, event-driven web application frameworks and tools for rapid development of high-performance, highly reliable web servers and client programs. Apache is Apache's open source message bus.

### 3.2.2. Data processing layer

Data processing can be performed using parallel data processing system, advanced data processing system, and existing data processing library.

Parallel processing software according to the data characteristics, mainly divided into three categories, batch processing system, streaming data processing system and graphic data processing system.

The batch processing system mainly includes Hadoop system, Spark system and Hama system.

In Hadoop system, the MapReduc model is employed to batch processing. The Spark system is the memory version of the Hadoop system. In Spark system, data is treated in main memory, which eliminating the steps to write data to the disk during the computation, thereby increasing the transport efficiency. The Hama system is a top-level open source project of Apache. Hama system

uses large-scale parallel computing algorithms (Bulk Synchronous Parallel (BSP)) for big data analysis.

Stream data processing system mainly includes Storm system, Spark Streaming system and Samza system.

The Storm data processing system is a distributed real time computing system, and processed data in real-time.

The Spark Streaming system utilizes batch processing for data streams.

Data in Samza system are processed as a message. Samoa system processes each received message separately.

The graph data processing system includes Tez system. The Tez system is a new distributed execution framework for Hadoop data processing applications, which convert multiple dependent jobs into one job, thus greatly improving the performance of DAG jobs.

Advanced data processing system is based on underlying parallel processing system. Advanced data processing system uses the structured SQL-like query language to call the underlying processing system. Hive as a data warehouse system, using the SQL query language to call the hadron system. The Pig system is a data analysis system that performs analysis tasks by utilizing advanced Pig Latin languages. In addition, shark, MRQL and other systems, are based primarily on Spark and Hadoop systems.

In addition, there are some data analysis libraries, such as the machine learning Apache Mahout, the Mllib library, etc. R system is used for mathematical statistics. Male system is used for image processing. These can be drawn up and developed according to the needs of upper business.

### **3.2.3. Operation management layer**

For the operation and maintenance layer, mainly related to the message protocol, distributed coordinator, monitoring system and security privacy. In numerous commercial products, this part is the focus of attention.

In open source products, the distributed coordinator is the ZooKeeper system, which is mainly used in Hadoop systems. In commercial products, such as clouded's hardtop system, the coordinator part was rewritten to make it more robust and efficient.

For monitoring systems, it mainly includes Ambari, Ganglia, Nagios, etc. For this type of performance monitoring systems, in commercial products, it's optimized to make it more concise and convenient for the end user.

In this section, mainstream software for the sales platform is introduced. It would help the user to design the platform.

## **4. Conclusion**

Sell side reform is a long-term process. During this period, the sale of electricity business will continue to change, which is worth for supplementary study. In this paper, combined with the successful model of foreign electric companies, we design the platform from the functional level and technical aspects. In functional level, it can be separated into data storage layer, data analysis layer, application service layer and operation and maintenance management layer. At the methodological level, the platform is designed primarily based on open source Apache products. Based on open source products, the platform can be introduced in a more inclusive way, avoiding the limitation of focusing on a certain point in commercial products, so that users can better understand the platform. In addition, it is easy for users to perform mechanical verification. This paper has some reference value for the strategic planning of the electricity sales company.

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