Research on Smart Grid Information Platform Integrating Cloud Computing Technology

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Abstract: The future power grid will be a highly automated, intelligent power grid, such a large, complex system from power generation, transmission to change, distribution, power process will always generate massive amounts of power information and equipment operation status data, which requires a strong information processing platform as a support, and this platform should have a reliable storage of massive data, accurate analysis, real-time synchronization update and sharing functions, especially audio and video and other heterogeneous data analysis and processing, cloud computing technology has a unique advantage in big data processing, the cloud computing technology will be used in the paper to integrate the cloud computing technology, information platform research on smart grid. This platform should have the functions of reliable storage, accurate analysis, real-time synchronous updating and sharing of massive data, especially the analysis and processing of heterogeneous data such as audio and video. Cloud computing technology has unique advantages in big data processing, and the paper introduces cloud computing technology into the construction of future smart grid information processing platform, discusses the functional requirements of the future smart grid information processing platform, compares the many bottlenecks of the current grid information processing platform, and proves that cloud computing technology can be applied to the future smart grid information processing platform, which can help to improve the efficiency of the information processing platform. It proves the feasibility of applying cloud computing technology to the future smart grid information processing platform.

Keywords: cloud computing; smart grid; information platform; research

1.Introduction

Smart grid in the provision of green low-carbon clean energy at the same time greatly ensure the security and stability of the system operation, power users can participate in the whole process of power distribution throughout the grid according to the real-time power information, a variety of distributed renewable energy access to diversify the power supply pattern in the system, the information processing platform is like the nerve center of the grid, in order to ensure the stable operation of the grid and maximize the benefits of the role can not be ignored. It has a role that cannot be ignored[1].

Based on the characteristics of the power grid, such as large scale, complex data model and wide range of dimensions, the power grid is a very complex and complex system. In particular, the input and use of solar energy, wind energy, hydroelectric power plants and other power

generation methods have resulted in a complex structure of the grid system and a large amount of data. The structure of the grid system is more complicated and the data is quantized. The application of cloud computing technology solves these problems. Cloud computing can realize the integration and management of data, information and resources, and provide the smart grid with the necessary information[2]. and management of data information and resources, and provides resource intensive configuration and data information storage for smart grid. storage of data and information. Cloud computing's platform management technology enables a large number of servers to collaborate and cooperate, which facilitates the deployment and storage of services. The technology of cloud computing for platform management enables a large number of servers to cooperate, which facilitates the deployment of services and the maintenance of faults. In the smart grid information platform, there are many types of information systems. In the smart grid information platform, there are many types of information systems, and a large amount of data makes the processing and management of them extremely tedious. The traditional data and information management software is unable to meet the requirements for storing and managing massive data. The traditional data and information management software cannot meet the storage and management needs of massive data. The advantage of cloud computing is that it can effectively store and manage large amounts of data. data storage and management functions, in line with the needs of the power grid, and is important for the construction of the smart grid information platform has important practical significance[3] .

2.Grid information processing platform

2.1 Current GIS Platforms

Currently, the information processing platform of State Grid Corporation adopts traditional solutions, such as the platform infrastructure using expensive large servers, storing data on disk arrays, and adopting relational databases for data management, etc. All these will result in high cost and poor scalability of the system, which will be very difficult to adapt to in the future processing of big data in the smart grid. Data acquisition, storage management and access functions together constitute the core content of the current grid information processing platform.

2.1.1 Data Extraction

In the acquisition layer, the extracted business data is transformed into standardized data and then loaded into the subject database, ETL is responsible for extracting the data from the data source to the middle layer and performing ETL, and finally loaded into the data warehouse or data set to become the basis of the data center to realize the process of transforming the data source into the target data warehouse[4].

2.1.2 Data Access

The data access layer is used to realize functions such as query, analysis, OLAP and data mining. Reporting system shows the production and management data at a glance, easy to fill in, deploy and view, automatic statistics, sub-functions to generate a variety of potential charts for production and management decisions to provide a direct basis for reporting can also be

based on the changes in the production time period of the new business, such as the quick addition, deletion of business, to facilitate the application of grass-roots units, the results of the application of the data display is called the front-end processing of the data, which can be carried out through the online or Web The result of the data display application is called data front-end processing, which can be carried out online or through the Web[5].

2.1.3 Problems

Lack of unified information management. The units directly under the State Grid and the provincial network companies build their own data centers in accordance with their own production and management characteristics, but due to the great differences in their respective business systems, the networks, servers, databases, and monitoring and other aspects of the data center construction are different[6], and hardware and software, data resources, and maintenance and management of the equipment and technology used by the various aspects of the increase in the construction cost.

The current grid information processing platform has been unable to meet the needs of the future smart grid massive data storage, sharing and processing, so it is especially necessary to build an information processing platform with distributed storage and parallel computing suitable for the future smart grid in order to make the data center obtain more functions and services.

2.2 Functional Requirements of Smart Grid Information Platform

An efficient, open and shared information processing platform is the foundation of the future smart grid, which is also the key to distinguish it from the traditional information platform. To summarize, the information processing platform of the future smart grid should have the following three functions.

1) The construction of the whole information platform should cover the whole process of power generation, transmission, transformation, distribution and use of electricity, and be able to collect information comprehensively, transmit it at high speed and process it effectively, so as to highly integrate electric energy, information and various businesses[7].

2) It has a collaborative business and mutual operation system with transparent information sharing, standardized integration and comprehensive functions.

3) Reliable storage and management of massive heterogeneous data to maximize the value of information extraction and enhance the overall analysis and decision-making level of smart grid.

The establishment of a secure and flexible massive information processing and computing platform is the basis for the construction and development of smart grid, and cloud computing technology can provide a complete set of solutions.

3 Cloud computing technology research progress

Cloud computing (CloudComputing) is an Internet-based service use and delivery methods, hardware and software and other information resources stored in the cloud a data center, can

be provided on demand through this way to other devices on the network, the user through the Web service to access the software stored on the server and other information, which means that the computing power can be used as a commodity to circulate on the Internet. In recent years, the Internet-based integration of virtualization technology, cluster applications, grid computing, distributed storage and parallel computing advanced technology has emerged in large numbers, in the cloud computing system, the distributed storage of data and parallel computing is the core technology[8], Hadoop as the representative of the open-source framework for distributed computing to fully integrate the cluster nodes of the storage capacity and computational efficiency, with certain advantages. The cloud computing system model is shown in Figure 1.
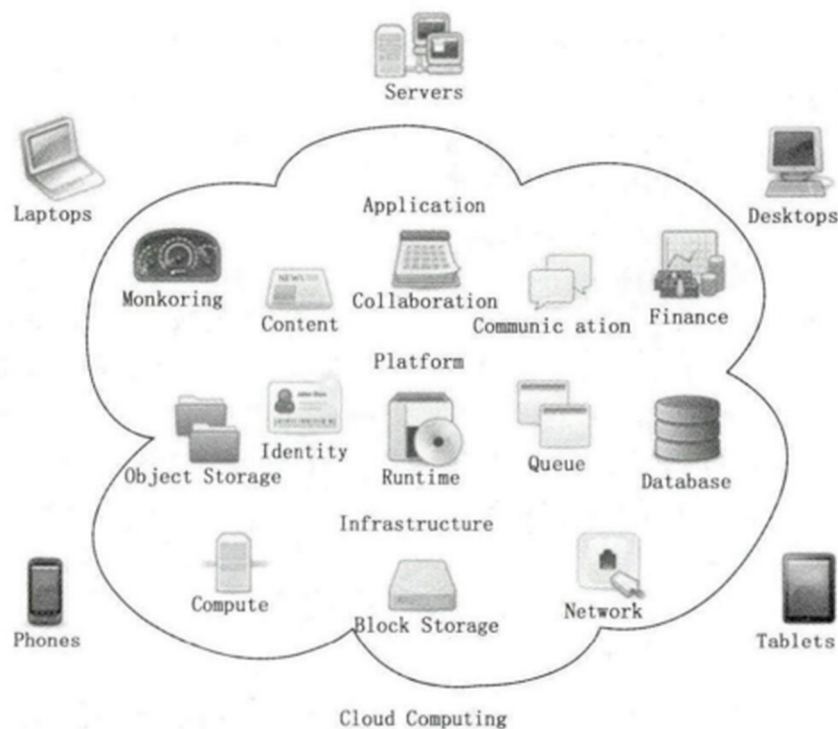

Figure 1 Cloud computing system model

Amazon, Microsoft, Google, IBM, Intel and other companies have put forward a "cloud plan", such as Amazon's AWS, IBM and Google jointly developed the "Blue Cloud" program, etc., which have given great affirmation of the commercial value of cloud computing. Academics are also conducting in-depth research, Google, the University of Washington and Tsinghua University to start the Academic Collaboration Program on Cloud Computing (ACC), in order to promote the research and popularization of cloud computing Carnegie Mellon University to start the data-intensive supercomputing (DISC) program Cloudera Inc. to design and implement a Hadoop cloud-based platform for the Smart Grid in the Tennessee Valley Authority (TVA) on the project, to help the Tennessee Valley Authority (TVA) to help the Tennessee Valley Authority (TVA) to develop a smart grid[9].

4. Application of Cloud Computing in Smart Grid Information Platform

4.1 Hadoop cluster architecture and features

Hadoop is an open source cloud computing platform, its core components include HDFS distributed file storage system, MapReduce parallel computing framework and HBase architecture on top of HDFS distributed, column-oriented storage system. Its high reliability and scalability can well meet the needs of the future smart grid information processing platform, the main features are as follows.

1) Hadoop cluster backup and fault recovery functions are very mature and can be widely used in a large number of inexpensive hardware equipment to provide a stable and reliable interface for the application, and its high degree of fault tolerance can be a reliable storage of large amounts of data for the smart grid.

2) Hadoop cluster has good load balancing characteristics. When the remaining space of the idle node is less than a certain value, the system will automatically transfer the data to other nodes, so it can cope with the situation when the load becomes large.

3) Distributed data processing and distributed structured data table can be compatible with structured storage, shielding the underlying distributed programming, making the development difficulty lower, and ensuring the query and access of high throughput in the case of massive data of smart grid.

4.2 Hadoop-based information processing platform

4.2.1 Mapreduce System Structure

Compared with the traditional grid data analysis, processing, cloud-based platform for smart grid MapReduce data processing is no longer a conventional relational database and disk array, but a complex and huge system consisting of servers, network equipment, client programs, application software, public access interface access network and many other parts, including column storage, documents, graphics and K/V and other non-relational Distributed database, flexible deployment of task resources, storage, computing power, high equipment utilization[10].

The core components of the basic resource layer are used to realize the virtualization of task resources and make them merged into clusters, and then realize virtualization, visualization management, and complete the cloud computing infrastructure services[11].Mapreduce function is the core of the data processing layer, and different task functions are configured to meet different functional requirements, such as the introduction of neural networks, queue management, and genetic algorithms in order to meet the demand for resource scheduling.

4.2.2HBase data model

Object-oriented strategy to build the HBase data center model, because of its stable state of column clusters, and the element columns can be arbitrary growth, so the column clusters can be viewed as an object, column clusters in the sub-columns of the object's attributes, column clusters and the RowKey constitutes a HTable a combination of objects, will be defined as the

object name of the RowKey, in the HBase contains more than one HTable, each other there are Associative relationships, for NoSQL databases such as HBase to create a combined object model a COR model, HBase itself can not be maintained, but it has a massive amount of data distributed storage and parallel computing capabilities so that it can be directly stored data, so there is no data dictionary in COR, but rather, the data is encoded and stored in a table, which allows for accurate recovery of historical data.

Before creating the HBase model for the smart grid data center, build the Hadoop runtime environment and configure the HBase data, Hadoop is implemented by Java to load the JAVAHOME path in the hadoop-envsh file[12].

At present, the grid information system management platform is unable to achieve real-time synchronization and updating of all the information in the network, such as: load demand, substation and line equipment operating conditions, as well as other production and management information, which is due to the provincial networks, molecular companies, such as information management system vendors, put into operation time, operating systems and databases are very different, so the formation of heterogeneous data, these data are not exchanged, shared, and then formed a separate information system, which can not be exchanged. These data are not exchanged and shared to form an information island. In addition, the different environments in which the databases are running will also generate heterogeneous data.

Before creating the HBase model for the smart grid data center, first build the Hadoop environment and configure the HBase data. Hadoop is implemented by Java by loading the JAVAHOME path in the hadoop-env.sh file. hdfssite,xm] in the NamneNode and DataNode configuration is as follows.

value>|hadoop.tmp.dir)/dfs/data</value>//DataNode data storage path

</propcrty>property>

name>dis,datanade, tnaxxcievers/namevalue>4096/value//Up to the maximum number of files that can be processed simultaneously by the DataNode.

name>hbase.rooldir/name>

value>hdfs://192.168.1.103, 8888/hbase</value> //consistent with hadoop's core-site.xmh

/property><propertyname>hbase.cluster.distributed</name>value>truc</value>//   Distributed set collocation

/property><property

name>hbase.zookecper.quorum/name>

value>localhost</value> //must be an odd number /property

5. Conclusion

Cloud computing is an emerging technology developed in recent years that can realize high-performance distributed storage and parallel computing, the integration of massive

distributed computing resources so that it has good scalability, high reliability and a high degree of automation, virtualization and other characteristics, cloud computing technology is still in the early stages of development, cloud computing technology into the future of smart grid information processing platform is also in the exploratory stage, there are still many problems to be solved. There are still many problems to be solved. Based on cloud computing technology, the grid information processing platform can to a large extent fully integrate the storage and computing resources within the current system to realize the efficient processing and interactive functions of the future smart grid massive data and information, which has certain application value in the future smart grid information processing platform.

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