Model design for big data clustering analysis of power dispatch automation system based on cloud computing platform

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Abstract: Cloud computing and big data are closely linked, profoundly affecting the way people live and work. They also have more established applications in power dispatch automation. This paper uses cloud computing as a technical tool to analyze the power dispatch automation system, and discusses the application aspects based on the model construction.

1 Introduction

A very important application of the power dispatch automation control system has a strong supporting role for power dispatch. An electronic dispatch automation system based on a cloud computing platform is of extraordinary significance to improve the level of power dispatch intelligence. In particular, the application of cloud computing technology to practical work requires the support of big data, which requires a corresponding big data analytics model. The first part of this paper analyzes the basic status of power dispatching, the second part analyzes the common failures and troubleshooting measures of power dispatching, the third part introduces the specific application of cloud computing, and finally the model design and analysis.

2 Status of the application of power dispatch automation systems

2.1 Analysis of power distribution control equipment and power supply equipment

Power dispatching equipment is a very important application of modern computational control systems, using the more popular current LAN technology, which is done through the better performance of Siemens PLC and fieldbus technology. The system works well and is also easy to maintain, consisting mainly of instrument actuators, signal processing modules and operating stations, all hardware components need to be supported with PCS7 software. This software is used extensively in industries such as power plants and is very useful for the completion of tasks related to power dispatch.

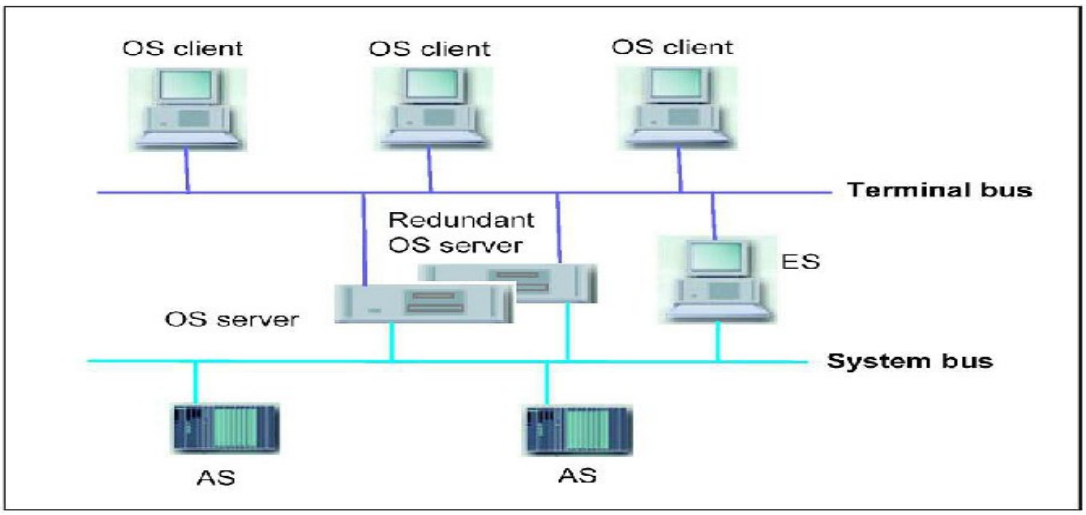

Figure 1. PCS 7 system

For all electronics cabinets, the corresponding electronics cabinet should be distributed, which should be able to receive two AC circuits, 220 volts AC, with no more than 10% fluctuation up and down. The individual cabinet power supply should be configured to synchronize with the circuit protection equipment, and should also include a power switching device so that the power supply has enough capacity and voltage to handle it, automatically switching in the event of a working power failure, so that the backup power supply can power it without affecting the work of the components. If there is a power failure, the alarm should be carried out, so that part of the circuit is automatically switched in the event of a failure, so that the other part of the work, so as not to cause power failure in the electronics cabinet, should also be installed in the feeder dispersion device, so that the reliability is better, can contact the input signal of the transmitter and at the same time, in the event of a short circuit, can also be shorted to the other input channels do not affect the operation. In the system cabinet, all equipment should have some means of electrical isolation, if the power supply is removed the alarm is required. This circuit is operated by means of intelligent control and should be detected and treated in the event of insufficient supply voltage within the control range of the entire system.

2.2 The direction of development of the power dispatch automation system

Bus Control. The heart of the power dispatch system is controlled by way of a bus. The use of sensors and transmitters to transmit all devices makes it easy to control complex signals and to detect and correct data errors that occur during transmission through the transmission error detection function. A fieldbus is a more reliable automatic control device that is installed in the current area. It can replace the existing communication network and make it more adaptable to industrial construction, allowing for precise control of the equipment. In order to achieve interoperable operation of the bus, it is possible to interconnect as long as the same protocol is followed. The building blocks also provide a comprehensive connection between the gateway and its parent network, enabling the manager to analyze the actual power dispatch of the power plant equipment, which will further improve the efficiency of the power dispatch and enable more reliable control.

Field device intelligence. By placing the control function in the instrumentation in the field, the instrumentation control currently allows for supervisory control and optimal adjustment of the data. By optimizing the instrumentation, the indoor instrumentation can be operated more reliably and the system can be better supported by the digital field equipment. The power dispatch system performs two-way control of automatic control devices and field equipment, which must operate under the same bus protocol in order to communicate with each other. At the same time the fieldbus needs to be controlled at the field level to realize its own functions. As a result, the field unit needs to be digitized and intelligently modified to make it more reliable.

Information processing is on-site. For the control system, whether it is a decentralized control system or a fieldbus, the system needs to process a lot of data to guide the control through the collection of field information, so that the ability to transmit information is further improved. On the other hand, there is a need to reduce the multidirectional transmission of information and to avoid large data tolerance situations. At the same time, the process is transmitted via the fieldbus to the control device, which needs to check the status of the individual field instruments and then save their data. The system is currently open, but also has good operability and applicability to industrial equipment, but is not currently widely used.

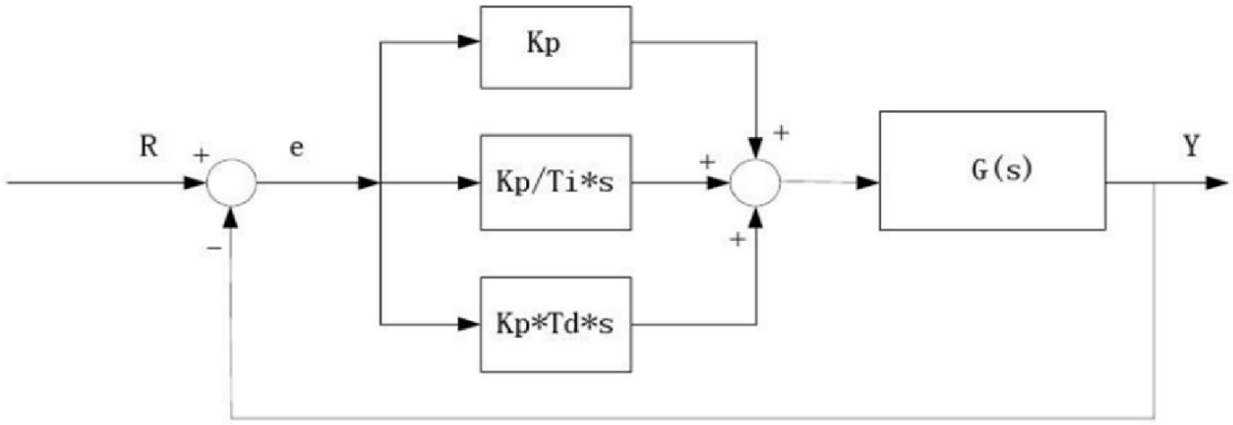

Figure 2. PID control system

3 Common faults in the operation of power dispatch automation system and treatment measures

Electricity dispatching is an extremely important link in the process of using electricity dispatching resources, which plays an indirect role in determining the role that electricity resources can play. In the course of power dispatch operations, a number of failures often occur.

3.1 Common failures in power dispatch operations

Front-mounter failure. The preamplifier is an important part of what makes up the power dispatch system. If the light is flashing at fixed intervals during the preamplifier monitoring operation, there is no fault. If the channel board is faulty, the channel board can be replaced after the shutdown, and if there is no spare channel board, the faulty chip and the spare chip on the channel can be switched. In addition, in the event that it is not possible to reconcile, you can first check the switching power supply to determine whether there is a problem with the automatic switching position, and then adjust it.

Database failure. The sharing and updating of data is a function of the grid dispatch automation system, and during the process of power dispatching, some time-dependent data may appear, and the database may often fail. There are many reasons for these malfunctions, which require maintenance personnel to first check the switch position and database polarity. If the remote signal is normal, but the remote control time is extended, the equipment signal should be further checked in the case of normal channel.

Network system failure. Real-time data source is the information used by the grid dispatch automation system, which contains a very large amount of direct raw data, while most enterprises choose dual-card and tri-card internal bridge segmentation networks, which are less physically isolated and have a relatively serious secondary protection problem, which is extremely vulnerable to hackers or viruses, thus resulting in the destruction of power dispatch data. In response to this malfunction, companies should take additional precautions, strictly prohibit foreign copies of programs, apply a combination of software and hardware security measures, and isolate illegal information.

Master station equipment failure. Master plant failure is an extremely common type of electrical dispatch operation failure. During the subsequent control phase of the power dispatch system, inappropriate grid connections often occur, which can damage the main station equipment to a certain extent, thus affecting the operation of the power system. At the same time, during the operation of the scheduling system, conflicting network IP addresses can occur, which causes changes in the operation of the scheduling system. These phenomena will have a certain impact on the main station's space system and equipment data, and if there is a problem, it will affect the normal and stable operation of the power system.

3.2 Measures to deal with power dispatch operation failure in China

The first is to improve the overall quality of scheduling managers. Companies should conduct regular training and education for power dispatch operation staff to effectively improve their own professional skills, so as to minimize the probability of failure. In addition, it is necessary to strengthen and improve the resilience of the staff, so that they can be more alert to the danger points and failure points in their work, so as to effectively avoid the occurrence of operational errors, thereby promoting the safer and more stable development of China's electricity industry.

The second is to upgrade the system equipment. Enterprises can upgrade the power system equipment according to the actual situation and condition of its operation, so as to avoid the impact of some failure problems, and thus effectively improve the ability of the system equipment to resist interference. Since power dispatching systems operate under a variety of conditions, it is important to minimize interference from internal factors and strengthen the resistance of power equipment and related lines to interference.

Third, to strengthen the monitoring of the operational status of the power grid. To ensure the stable and safe operation of the grid, it is necessary to monitor every aspect of its operation with greater intensity. In addition, the enhanced monitoring of danger points also enables the timely detection of abnormalities in the operation of the grid. After effective repair work, not only can ensure the safety of grid dispatching, but also can effectively improve the level of grid operation failure prevention.

The fourth is to develop a plan for relevant troubleshooting. Power enterprises should strengthen their attention to the safety of power dispatching, conduct a comprehensive discussion and analysis of power dispatching system failures, and establish a fault handling mechanism. Due to the specificity of our electricity distribution mechanism, a timely data audit should be carried out at the control stage, and different approaches should be used to address the current shortcomings of the enterprise. In addition, the company must put into practice a plan to deal with the problem so that the staff concerned can carry out better inspection, detect the problem in time and solve it according to the analysis of the type and cause of the problem.

4 Application of cloud computing in power dispatch automation system

Cloud computing technology can effectively address the increasing complexity of engineering calculations and non-linear optimization in power systems. Specifically, the application of cloud computing technology in power dispatch automation systems has two main aspects: expert system and visualization technology.

4.1 Application of the expert system

One of the most widely used artificial intelligence technologies is the expert system, which is primarily a system that simulates human expert problem solving. In a given field, an expert system is a knowledge base with a large amount of expertise that is formed by summarizing the knowledge experience of experts in the field and achieving control of the overall system based on certain rules. In the power dispatch automation system, the application of expert system is to combine the existing information technology professional knowledge with the relevant professional experience in the field of power system, build an expert database, and network simulation of the expert problem-solving process, so as to help the relevant staff accurately and quickly judge the problems in the system and propose effective countermeasures.

The most central part of the expert system is the database that brings together specialized knowledge and experience. The first difficulty that needs to be solved in order to improve the application of expert systems in the power dispatch automation system is the establishment of a complete database. To ensure a strong applicability of the expert system, it is necessary to continuously enrich its body of knowledge, acquire a deeper level of expertise and effectively enhance the value of the application. The causes of possible operational failures in the operation of power dispatch automation systems are very complex, and with the development of society, the complexity of the problem is increasing, making its operation more challenging. Through the application of the expert system, using the rich expertise and experience in the database, it can greatly improve the system operation fault diagnosis and processing efficiency, and has a very high use value.

4.2 Application of visualization technology

As the demand for electricity continues to increase, the amount of information within the power system has increased significantly, showing a diversified, nautical trend. The application of visualization technology can effectively relieve staff stress and reduce the difficulty of work. Through visualization technology, workers can view data more visually in graphs and pictures, thus improving the efficiency of power dispatching. Specifically, visualization technology is the use of two-dimensional and three-dimensional visualization of information data through the use of technical means to map, so as to visualize the image of information data, the complex data in an intuitive way to show the image. By observing these images, power dispatching staff can accurately and quickly find the point of failure, take effective measures to solve the problem in time to ensure the efficiency of power dispatching work.

4.3 Artificial neural networks

In artificial intelligence systems, artificial neural networks are used to mimic the human nervous system to achieve information processing and transmission, a technology that is widely used in power dispatch automation systems. The application of artificial neural network technology in the power dispatch automation system is mainly to achieve high-speed information processing and transmission to ensure the accuracy of information processing. At the same time, in the power dispatch automation system, the application of artificial neural network technology can also realize the parallel processing of information data, associative memory and online learning, etc., which helps the power dispatch automation system to detect and deal with faults in time, greatly improves the efficiency of fault analysis and processing, and provides important guarantees for the normal operation of the power dispatch automation system.

5 Construction analysis of cloud computing technology in power dispatch automation system

Power dispatch systems are at the heart of smart grid development. In the actual power dispatch information development process, it is easy to appear that the technical route of dispatch system at all levels is not uniform, the operation content is not consistent, etc. The use of cloud computing and related virtualization technologies can circumvent these problems.

5.1 Problems with cloud computing applications

The scheduling automation system is built mainly on the application of fixed topology, each server can only run in a fixed module, and the function is single, only with the cooperation of multiple servers, the whole automation system can maintain a normal state of operation.

In the course of operation, the main problems are that the overall architecture is too complex, difficult to maintain, poor disaster tolerance.

5.2 Specific applications

One is the repackaging of the scheduling master system. In order to solve all the drawbacks of traditional dispatch automation systems, cloud computing technology has been applied to the design of new dispatch automation system architecture. The re-encapsulation of the scheduling master system is important for the application of the entire cloud computing technology. At this point, the original server becomes part of the resource pool and not only has the same topology connection method, but also the management configuration method is unified. In addition, on the master system modules and virtual machine packaging, mainly in the form of files, the specific operation resources are mainly from the resource pool control center of the rational allocation.

The second is the way in which the data centre is built. In the process of building a cloud computing data center, it is necessary to demonstrate the replicable characteristics of different environments, and realize the integration of automated scheduling resources in multiple

regions to provide the basic conditions for the construction of off-site cloud computing data centers. In this process, many different areas of the dispatch automation system can be connected in a stable way, providing security for the entire system operation. In addition, in order to ensure the stable operation of the data center, the staff can also link the system to other regional cloud data centers through the collection of cloud data, so that the entire disaster data recovery process will be fully secured. If the entire system can be kept up and running for a long time, the entire master system and the cloud computing center will also remain in sync. When an exception occurs, the remote end of the system is already in synchronization with the virtual machine files, and specific resource integration can be carried out according to the system requirements. In addition, by backing up with each other, both parties can ensure that the detection mechanism is both manual and automatic, and if a fault is detected, it will be passed on to the administrator at the first opportunity to avoid adverse effects on the system.

The third is the scheduling terminal system construction. The terminal system is built with a sandbox program running as the main line, and then data is sent through multiple copies of the scheduling content in the virtual machine and different terminals. As a result of this operation, the number of programs in the terminal system will be reduced, but one can generate several new copies of memory by copying the operation to keep the scheduling platform consistent for more users. In addition, in the subsequent upgrade operation, the main work is focused on the source program file changes, so that the user program can be upgraded simultaneously.

Table 1. Comparison of the architecture of the new dispatch automation system with the legacy system

Comparison project	Traditional structure	New architecture
overall structure	Localization of resources	Networking of resources
Information processing subsystem	Woo Hing Server Dual Unit Backup	Servers stand by for each other.
Information transfer subsystem	Traditional dedicated sports lanes	Orchestrating virtual private data networks

6 Conclusion

The emergence of cloud computing technology has brought about a profound change in scheduling automation systems, making the pool of resources more reliable by making full use of the original resources, making the system application-level disaster recovery protection effectiveness greatly improved. Based on this, the decoupling of hardware and software will be smooth, and the specific system operation and software operation will not need to be related to physical devices, resulting in increased system flexibility.

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