

Application of Cloud Computing in the Emergency Scheduling Architecture

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Abstract: For unexpected events occurred frequently, requirements of emergency material dispatch are increasingly high. Meanwhile, requirements of the accuracy and timeliness of data analysis and processing are more intense. The cloud computing technology is applied in the field of emergency material dispatch and the Internet of things architecture in emergency material dispatch process based on cloud computing technology is studied further. Storage technology cloud computing architecture and related resources call technology in computing resources pool provide high reliability of emergency material storage service and efficient cloud computing services, thus supporting the development of emergency decision-making and improving the efficiency of emergency material dispatch. With cloud computing, it makes the biggest possible realization of the time benefit maximization and dispatch cost minimization.

Keywords: Cloud Computing; Cloud Storage; Internet of Things; Emergency Dispatch; Architecture

INTRODUCTION

Unexpected events is an emergency event that beyond all expectations and out of control, in general, they have the characteristics of strong destructive and high burst. In recent years, although the economy has been rapid development and people's living standards have been significantly improved, but all kinds of unexpected events also occur frequently. From the 2008 snow disaster, 5.12 Wenchuan earthquake to 2010 Qinghai Yushu earthquake and so on, they endanger the lives and property of the people directly, and even lead many families to be fragmented. Therefore, after the occurrence of unexpected events, how to dispatch the emergency supplies timely, fast and accurate, and how to reduce the disaster losses maximum degree, and they become the focus that we should pay more attention to.

There are so many shortages like reserve disorderly, data highly redundant, scheduling decision for a long time, transport speed slow traditional in emergency material dispatching system, they all have a direct impact on the overall efficiency of emergency material dispatch. With the development of Internet of things, cloud computing and Internet technology, emergency material

dispatching is more likely to be information. We can through set up emergency material dispatch system that in the environment of the internet of things and be supported by cloud computing technology, to improve the timeliness and accuracy of emergency material dispatch, assist decision making scheme, improve the transportation efficiency, so as to realize the maximization of time efficiency and the minimization of scheduling cost.

KEY TECHNOLOGIES IN INFORMATION EMERGENCY SCHEDULING ARCHITECTURE

Along with the arrival of the Internet era, the level of information and network sharing in modern society has been improved continuously, in addition, with the rapid development of emerging technologies such as cloud computing, big data, networking and other things, the integration of the physical world and information world is becoming more and more closely. Through to apply these advanced information technologies to the emergency material dispatch field, we can make the management of the whole emergency scheduling system to be more convenient, and make the material scheduling to be more intelligent. Now we focus on several advanced information technology:

internet of things, internet of Vehicles and cloud computing.

Internet of Things

Things technology is committed to the integration of physical space and information space, so as to achieve the integration of virtual and real, improve the physical world of intelligent management. It mainly consists of sensors, radio frequency identification and network communication and other key technical support, so as to achieve the state that things are connected to things.

Sensor technology

Sensor is a kind of information gathering tool, the main function is to collect the information of material in different environment, and take the information with the specific electrical signal to the host computer for data storage. It is the data source of the Internet of things, and it is also the data base of the intelligent scheduling and information management of the Internet of things. At present, the sensor technology is developing in the direction of intelligent, intelligent sensor will be an important symbol of the future development of intelligent network.

RFID

Radio Frequency Identification(RFID) is a new automatic identification technology. It uses radio frequency signal through the space coupling to realize no contact information transmission, through the transmission of different signals, identification tags within the different information, so as to achieve radio frequency identification.

In the structure of the Internet of things, the application of RFID system is the key part. We make use of the RFID system to paste the EPC tags to the single product, and use of the uniqueness of the EPC electronic tags to achieve the only identification of material. So as to record the corresponding type of single product, storage information, single product number, quality assurance information and so on. Finally, the reader reads the EPC encoding in the tag, and transfers the information to the corresponding server, so as to achieve the binding of EPC tags and materials.

Network communication technology

Network communication technology is the integration of computer network technology and communication technology, and it is the key technology to achieve the Network sharing technology and the material related.

In the entire architecture of the Internet of things, the application of network communication technology has always been through. From the sensor information collection, to the RFID

information read, transmission and storage, each step can not be separated from the technical support of network communication. And with the development of wireless network technology, its application in the Internet of things has become more and more convenient, so that the whole system is running more smoothly, and the development of the Internet of things is more perfect.

Internet of Vehicles

The Internet of Vehicles is the integration of GPS, RFID, camera and other devices and the Internet technology, all the information stored in the vehicle is stored in the vehicle networking database, and then the information processing server through to analyze the processing of the demand and vehicle data information, to develop the best vehicle scheduling scheme and scheduling route.

The concept of the Internet of Vehicles is similar to things, and it applies the concept of things related to the field of transportation. The development of the internet of vehicle, it not only can promote the construction of urban intelligent management system, such as smart city and intelligent transportation, and if we apply it in the fields of the logistics and emergency material dispatch and others, it can promote the improvement of the material dispatching system, and improve the efficiency of scheduling.

Cloud computing technology

Cloud computing is a new computing model based on Internet technology and distributed system, which is integrated distributed computing, parallel computing, utility computing and network technology, virtual technology together. With advanced network sharing technology and server resources in appropriate resources pool, it could visit different network services according to demand and achieve resource dispatch fast.

Cloud computing technology has its own architecture, mainly dividing into four layers from the bottom: the infrastructure layer (IaaS), platform layer (PaaS), software service layer (SaaS) and management layer. The top three are horizontal technical layer of cloud computing architecture to provide users high-speed computing resources and friendly user interface. However, the management layer is vertical on the infrastructure layer, platform layer and software service layer to provide management support and maintenance. The main introduction of cloud computing of the three horizontal layer architecture is shown in figure 1.

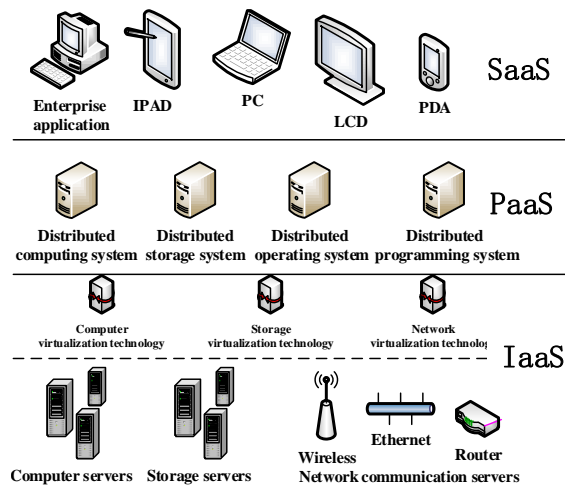


Figure1 Cloud computing architecture

IaaS

Infrastructure layer is the basis of the normal operation of the entire cloud computing architecture. According to the different demands of users, it calls different resource servers to provide computing, storage and network communication services for users through the construction of a large number of computer servers. Virtualization technology is the core technology to realize the infrastructure layer, the platform layer and the software service layer. By means of the computer virtualization technology, the computer server, storage server and network communication server are respectively virtualized as the computing resources, storage resources and network service resources.

PaaS

PaaS is in the middle of the cloud computing architecture, a virtual computer operating system layer which is used for providing users with development and cache services. Firstly, the infrastructure layer which provides resource for cloud computing service integrates the computer hardware infrastructure into the virtual distributed operating system by virtual technology. Secondly, the platform service layer provides the users with the corresponding cache, storage, computing and processing services by the network service interface.

SaaS

The software service layer is the final service layer that meets the needs of the user and is also the platform display layer which is directly experienced by the user. SaaS communicates by the Internet technology and cloud computing services. It could obtain relevant services through calling the resources shared in cloud computing architecture. In this mode, users enjoy cloud computing services by Internet communication technology with the payment of a certain service fee. It would reduce the

cost of investment in computer hardware, software and the team and improve the system maintenance efficiency.

Cloud computing management layer

Cloud computing management layer provides services for above three levels through the account management, SLA monitoring, billing management, security management, load balancing and operation management. It maintains the normal operation of the entire cloud computing system and improve the efficiency of cloud computing.

APPLICATION OF CLOUD COMPUTING IN THE EMERGENCY SCHEDULING ARCHITECTURE OF THE INTERNET OF THINGS

The technology of the internet of things is one of the most advanced technologies, and we apply it in emergency material dispatch, and construct emergency scheduling system based on it, can effectively improve the emergency material dispatch efficiency, and reduce the cost of scheduling. However, with the application of Internet of things technology in the field of emergency material dispatch, the related data is becoming more and more large and redundant, the data processing and information storage capacity of the conventional platform system can not meet the needs of the whole scheduling system. Therefore, how to improve the efficiency of emergency data processing and information storage capacity, and thus more effective emergency dispatch decision making is the most important research in the field of emergency dispatch.

Cloud computing technology through the use of distributed computing system cluster, distributed storage system cluster and other resource pool, to provide users with cloud computing and cloud storage services. Users can make use of the advanced network sharing technology and related cloud services to meet the needs of the data processing and information storage.

So the cloud computing technology is applied to the emergency material dispatching system based on the Internet of things technology. On the one hand, it can solve the complicated and redundant data caused by the introduction of the Internet of things technology; on the other hand, we can make full use of the efficient data processing and computing power of the resource pool, improve the efficiency of the emergency dispatch plan, and assist the emergency decision; in addition, the introduction of cloud computing services, can provide data storage services for the scheduling system in each node platform, so as to reduce the cost of building the node platform.

From the research of the emergency dispatch technology, we can divide the whole scheduling

framework into four platforms, such as emergency dispatch management platform, material reserve management platform, emergency vehicle scheduling vehicle networking platform and cloud computing service platform. Next we introduce the application of emergency material scheduling architecture that based on the Internet of things and in the cloud computing environment, as shown in Figure 2 below.

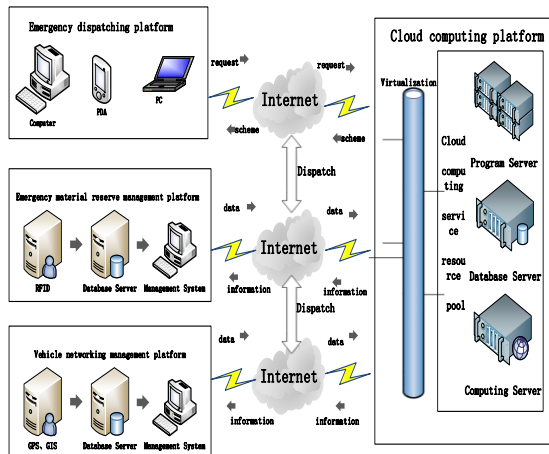


Figure2 Cloud computing and Internet of things emergency in material scheduling framework

Emergency Dispatch Management Platform

Emergency dispatch management platform is the core of the whole emergency dispatch system.

Firstly, in the event of unexpected events, emergency material dispatch management platform get the relevant information such as the time, location and scale so as to get the corresponding dispatch demands.

Secondly, the emergency dispatch management platform needs to transfer the data to the cloud computing service platform and analyze the basic data of the material and vehicle scheduling. What's more, it could get high efficient emergency scheduling through the effective data processing and intelligent scheduling algorithm based on cloud computing and feedback to the emergency scheduling platform;

Finally, emergency decision makers could select the optimal scheduling scheme and send them to the corresponding material reserve and emergency vehicle reserve center by emergency scheduling cloud computing platform provided to realize the whole process of emergency material dispatch.

Emergency material reserve management platform

Emergency material reserve management platform is the information management platform for each emergency reserve centre. It is the source of the whole emergency dispatch system data and

realized the information management of the emergency material dispatch executing nodes.

By applying RFID and information management platform technology, the emergency material reserve management platform achieves the information management of emergency material warehousing and material reserve centre. First of all, in the process of emergency material in-put warehouse, it is necessary to paste the corresponding EPC tag to identify emergency supplies only. Coding the target classification field of EPC tag differently could identify different kinds of emergency materials. In addition, it is necessary to set the unique sequence number to storage the emergency materials correspondingly.

In the warehousing management process, the manager could acquire EPC codes through scanning the EPC tags and all data are stored in the local database service and transferred to cloud storage service by network sharing and information transmission technology. On one hand, it is convenient to call dispatch data efficiently and information storage securely. The other hand, it reduces data storage demands of each material reserve centre and demands of local server configuration.

In the process of material dispatch, emergency material reserve management platform gets the corresponding scheduling instructions and calls data from cloud storage system and accordingly determines the corresponding specific scheduling scheme. With RFID technology and first-in last-out rule, it could make efficient and orderly management come true and achieve real-time data sharing to improve scheduling accuracy.

Emergency vehicle reserve platform

Emergency vehicle reserve center and emergency material reserve is a relation as one to one, one to many or even many to many, but in order to achieve more effective and timely emergency material dispatch, the best relationship is many to many. By establishing the relationship between the emergency material reserve and the vehicle reserve center, and making use of the characteristics of the vehicle's mobility, we can achieve flexible and real-time emergency dispatch within the principle of maximum benefit about the time.

Compared to the emergency material reserve center, the work principle of the vehicle scheduling management system is so similar to it, but the vehicle is more flexible and less deterministic than the emergency material. So the vehicle management system needs to install an independent GPS system for each emergency vehicle, to make the corresponding vehicle information to be bounded with the vehicle GPS positioning system, and push

them into the local database server and cloud storage server.

When the unexpected event occurs, we analyze the scheduling scheme from the cloud platform services, material reserve point position information and vehicle information of vehicle reserve center, to get the most reasonable vehicle scheduling scheme. Then to post the dispatch instructions to the corresponding vehicle scheduling platform. Finally, the vehicle scheduling management platform post the optimal dispatch instructions to the vehicle in different positions base on the vehicle information and vehicle location information in the database, Among them it is particularly important that transport the information about the GPS relative positioning information and reserve information.

Application of cloud services in Emergency Scheduling Based on Internet of things technology

Emergency material scheduling is more emphasis on the optimization of time cost than the common resource scheduling. And its purpose is to achieve the most effective emergency material dispatch in the shortest time. In general, emergency material scheduling is the face of unexpected events that it can not be sure about time, place, degree and so on. Therefore, how to develop the optimal scheduling scheme in the first time in the event of the occurrence of unexpected events becomes very difficult. And we introduce the cloud service technology into the emergency material dispatching platform, and make use of its very large scale and high reliability, and unprecedented high speed computing power, in the shortest time to develop the most effective scheduling scheme, and to solve the problem of reserve point management platform to bring the potential scheduling problems by use of its high reliability.

We apply the cloud computing technology to emergency material dispatch, and combined with RFID, GPS and other technologies about internet of things, so as to build a new emergency scheduling architecture system. And to collect information by the Internet of things technology, then to make use of the cloud computing technology to analyze and deal with the relevant data. And according to the relevant scheduling needs to formulate the optimal scheduling scheme, so as to achieve the optimal scheduling of emergency supplies for the decision makers.

The application of cloud computing technology in the field of emergency scheduling is divided into two parts: cloud storage and cloud computing, and they provide computing services and storage service to users by use of cloud computing resource pool and cloud storage resource pool.

Cloud storage services store data from material reserve and emergency vehicle reserve center in a cloud storage server, and make use of RFID system and GPS technology to achieve the purpose that storage the stock and position information of materials and vehicles, and store it in the local management platform database server, then the local information real-time storage and cloud storage server is used to provide technical support for realizing the real time sharing of emergency material and vehicle information. Below, we introduce several key technologies that combine cloud computing with the physical world.

Distributed Computing and Storage Technology

We introduce the cloud computing technology into the emergency material dispatch system, and take the main use of its high-speed cloud computing services and high reliability of cloud storage services. Its concrete operation principle is shown in figure 3.

In the process of emergency scheduling, the scheduling platform is transferred to the cloud computing system, and to access different cloud computing service resource pool based on its instruction.

When the cloud computing system receives a cloud storage instruction, cloud system calls the storage resource scheduling management layer, and through to introduce the distributed massive data storage and processing technology such as HDFS and HBase in distributed storage cluster, so as to realize the distributed storage of emergency material and vehicle data, improve the data storage capacity and data access efficiency of emergency dispatching

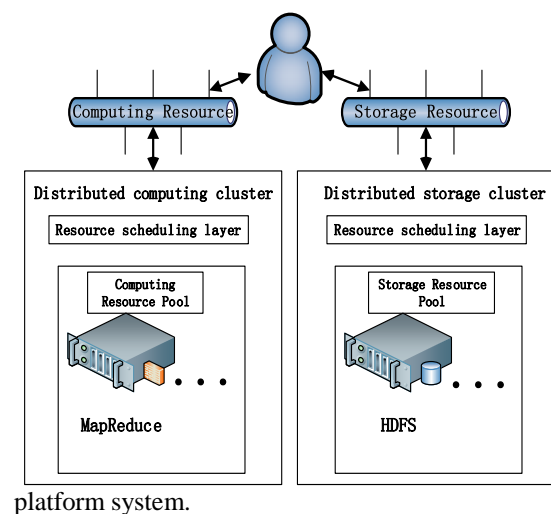


figure3 distributed computing and storage infrastructure

When received the emergency dispatch application instruction from the emergency dispatch management platform, the cloud computing

platform will post the instruction to the computing resource scheduling management layer, then to through the call of MapReduce and other cloud computing model, to achieve the data analysis and processing in the process of emergency scheduling is realized.

Computing resource pool make the server to be linked cloud computing service system with various computing models by network sharing technology, to build a cloud computing service resource pool that can provide different kinds of different computing models. As receiving the emergency dispatch instructions, the resource management layer is calculated according to the specific emergency instructions, and to access different computing model resource pool, and call different data analysis and processing algorithms. And applying the comprehensive coordination of all the resources of cloud computing services to achieve the purpose of rapid and accurate analysis of data and auxiliary decision-making

Virtualization Technology

Virtualization technology is the basis of providing virtual services for cloud computing by the underlying hardware server. On the one hand, it will abstract the infrastructure layer with numerous computing servers and database servers as a virtual cloud computing resource pool and cloud storage pool, to provide technical support for cloud computing services and cloud storage services. On the other hand, virtualization technology provides users with a virtual operating system and programming platform and so on, to provide users with the development environment, so as to reduce development costs.

Cloud computing the underlying server is the infrastructure of the entire cloud computing architecture. In order to link all of the cloud storage servers and cloud computing servers into the emergency scheduling system, we need to make the bottom server virtualization as a distributed computing system, distributed file system, distributed storage system and so on. To provide the material reserve such as windows, Linux, MAC and other operating system services and improve the level of reuse of the scheduling platform.

In summary, in the emergency dispatch system, the material reserve and the vehicle reserve center through the network share and the information transmission technology, borrow the cloud computing storage service, we push the details of the material and vehicle information into the cloud storage service pool, in order to reduce the needs for the permanent data storage on the local database. In this system, the material storage node only needs to temporarily store the material data in the most recent period, when the load capacity of the local

database to reach the safety level, the local database server will be partially invalid data or time longer data for selective destruction, so as to reduce the level of hardware configuration of the local reserve management platform, and reduce the cost of building the emergency material dispatching system. We store the data in the cloud service resource pool, but also can improve the efficiency of computing resource pool in cloud computing services, and improve the data analysis and processing speed further.

On the other hand, cloud computing technology provides a large number of cloud computing resource pools with all kinds of computing models for emergency material dispatch. In the process of scheduling, cloud computing resource scheduling management layer according to different emergency needs, call different computing resources pool with different computational models, to achieve efficient data processing and rapid decision-making functions. To apply the cloud computing services to emergency material dispatch, the key technology is to make use of its high-speed computing and data processing capacity, to reduce the time cost of dealing with redundant emergency data and unexpected events, and to shorten the time of emergency scheduling scheme, so as to reduce the loss of life and property caused by the emergency.

CONCLUSION

Emergency material dispatching is a huge system engineering, which is more emphasis on the accuracy and timeliness of material dispatch as compared to the common resource scheduling, therefore, we have very high requirements on data analysis and processing capability. However, the introduction of the Internet of things and the characteristics of the unexpected events have brought a lot of redundant data, which makes the accurate and efficient data processing and analysis become very difficult. The introduction of cloud computing technology can effectively solve the problem of data analysis and processing, through the integrated cloud computing, cloud storage, internet of things and emergency scheduling and other functions, and make use of virtualization technology, network sharing technology and communication technology to link the platform node together to build a large-scale linkage system, so as to assist scheduling platform to develop the optimal scheduling decision scheme quickly, and in the shortest time to complete the data from the data processing to assist decision, and to issue the finally issued instructions to implement real-time scheduling, and improve the efficiency of emergency material dispatch to reduce the unnecessary time loss of life and property damage.

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