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The framework of smart city based on cloud computing

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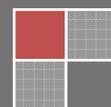
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ABSTRACT

Smart city is the new development stage of application of information technology in city management, and is a big issue we encountered during the process of city development. Cloud computing provides technology support for the construction of smart city. In this paper, the characteristic of cloud computing is analyzed and the three different service levels is pointed out. And then, the cloud computing system about smart city which includes infrastructure cloud, platform cloud and application cloud is set up based on Infrastructure as a Service, Platform as a Service, and Software as a Service. In the end, we analyze the role of infrastructure cloud, platform cloud and application cloud in the frame of smart city.

KEYWORDS

Smart city; Cloud computing; Infrastructure cloud; Platform cloud; Application cloud.



INTRODUCTION

Cloud computing, in which calculation and access are collected in cluster server in the network and application requirement from customers is served by the client browser software, is a kind of new information processing model. In recent years, cloud computing has gradually been a hot topic. From Google apps to Microsoft, cloud computing has gradually come into our life^[1]. As a kind of delivery and usage patterns about infrastructure and the service, cloud computing provides a kind of new way of information resource sharing and service.

In recent years, the integration of physical system about development of information represented by internet of things has become the new goal of city development. In order to reply the tendency, International Business Machines Corporation and Cisco Corporation provide the concept of “smart city”, which advanced city information to higher stage^[2]. At present, governments around the world paid much attention to cloud computing, and published relevant policies to encourage the development of cloud computing and smart city.

Smart city can form a kind of new life based on data mining from big data, engender new management model of information society by using information technology such as internet of things and cloud computing. A smart city can speedy and intelligently response to all kinds of city needs such as the people’s livelihood, environmental protection, public security, city services etc^[3].

The core purpose of smart city is to make information infrastructure more perfect, construct the platform of information sharing, and to provide automatic services for customers in application side by using single or multiple data sources and virtualization technology. And then, the public management of public, enterprise and city can receive more convenient services.

THE FRAMEWORK AND REALIZATION OF CLOUD COMPUTING

Cloud computing originates in distributed computing, parallel computing and grid computing. Cloud computing has the same operation way with internet, which means that computing is dispersed in a large number of distributed computers rather than the local computers or remote servers^[1].

The main characteristics are described below^[4]:

(1) Cloud system has the function of automatic backup and rigorous authority management. The data storage and data usage will not be affected when one computer in the cloud system crashes. So cloud computing can provide us with the most reliable and safe data storage center.

(2) All of the applications of cloud system do not operate in the client, so the requirement for processing capacity and storage space of the client computer is low. Meanwhile, since hardware and software are provided by cloud system management, maintenance costs of the client computers and requirements for computer equipment are low. So it is very convenient to use the system.

(3) Due to the application of all kinds of mobile devices which can collect information and the rapid development of internet, data and application can be shared among different equipments in cloud system. The clients who have one computer or electronic equipment can get the data and information they need from “cloud” by internet at all times. In the cloud system, every mobile terminal is the information demander, and also is the information provider.

Cloud computing provides three different service levels: (1) the infrastructure layer. Infrastructure as a service means that the client can receive hardware and virtual machine resources including computing resources, data storage resources and network communication resources. So the whole infrastructure, mainly the computing and storage resources can be treated as a kind of resource for the clients. (2) The platform layer which is located above the infrastructure is considered the core layer among the whole computing system. Constructed above infrastructure, platform as a service provides a platform to develop all kinds of application software, such as parallel programming development environment, the distributed storage management system about massive structured data, distributed file systems about massive data and the others management systems working with cloud computing. (3) Directly correspond to the client application, software as a platform means all kinds of application services developed based on cloud platform^[5,6].

In the first stage of cloud computing, the clients have physical data center. The server, internet and storage are concentrated physically, but these data centers are also isolated and resources can not be shared during this stage. Virtual data center, from which the clients can rapidly build cloud and can change physical center into cloud, is a necessary condition to realize cloud computing. Virtual data center provides cloud resources, and the public clouds between virtual center and exterior can help cloud computing by means of the relationship among clouds, and then the resource request from the clients will be met by automatic service mode.

THE CLOUD SOLUTIONS OF SMART CITY

Smart city is defined a kind of new lifestyle and social management mode, which can obtain massive information and filtrate the information intelligently by integrating information platform of the urban and constructing unified information sharing mechanism with the help of information technology such as internet of things and cloud computing and the information infrastructure. As a kind of new urban form, smart city changes the ways of communication among citizen,

enterprises and governments, and quickly responses to all kinds of requirements including people's livelihood, public safety, city services and business activities, and then make cities run more efficiently^[3].

Smart city means to collect all information resources from all information system supporting city operation and make them a bigger information sharing system under the support of the internet of things and cloud computing. At present, the main problem lies in city information resources integration is isolated information island. Due to lack of the common database construction standards, it is so hard to integrate the information dispersed in different departments and impossible to ensure internet and inter-communicating, resources-sharing. During the process of city development, the massive data accumulated in different departments can not be shared because of lack of sharing mechanism, and lead to information delay and information deficiency. This phenomenon will be adverse to the integration of information resources and the construction of smart city. So other than the unified standards of information construction, the data integration for different urban departments is also important for the smart city construction. Only when the above two points are satisfied, the object of massive data sharing will be achieved, and then all the citizen, enterprises and city participants can get the intelligent service, we can have a smart city^[7].

The key factor for the construction of smart city is to make the communication and information infrastructure more perfectly, construct information sharing platform, and make all the city activities participants receive higher efficiently and more intelligent convenience services from the construction of smart city and the relative intelligent system. A successful smart city system should have city information cloud, in which all the relative city services should operate in the unified cloud platform, and all the resources can be shared among different parts of the system, and provide the clients with intelligent service by construction of virtualization technology.

So a smart city system based on cloud computing should have a platform which can integrate all resources and make the resources shared among the system, and then accomplish the interoperation among "clouds". A smart city system should be comprised of infrastructure cloud, platform cloud and application cloud, correspond to infrastructure as a service, platform as a service and software as a service respectively.

As the lowest resources layer, the infrastructure cloud provides the necessary basic physical resources including server, network, storage devices to meet the information demand. The infrastructure cloud is the foundation for all services and the information sources. The resource pool of infrastructure cloud is constructed by virtualization platform, and drew up by all the regulatory agencies of private cloud. In the end, we get the goal for standardization and collaboration. Lied between infrastructure cloud and application cloud, the platform cloud is the core layer and the key factors for information sharing. The function of platform layer is to manage regional cloud resources and integrate data resources from infrastructure cloud by the ways of data collection and data switching. After being integrated, the resources need to be reprocessed, numerous application tasks need to be dispatched, and then the resources can be used efficiently and safely. Application cloud lies in the top-level of the whole cloud framework, and is the implementation layer for information sharing. The main function of application cloud is to provide implementation platform. In this layer, we can develop all kinds of government affairs clouds to meet the requirements from city activities participants^[8].

CONCLUSION

The development of cloud computing technology dramatically improved the ability of internet to provide services. The services mode and the new network platform constructed by could computing advanced a kind of new information resource management platform. The application of cloud computing in smart city can integrate effectively city information resources, and resolve the problem of information isolated island existed chronically in urban information resource management. The application of cloud computing in the fields of intelligent medical, intelligent transportation and intelligent logistics will enhance the information utilization efficiency of all kinds of city activities and provide convenience life for the people.

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