

A Spatial Data Security Model Under the Cloud Environment

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Abstract. With the cloud computing time arrival, spatial data storage and management technology based on cloud computing are getting more extensive attention and application. But under the cloud environment, how to ensure that the data stored in the cloud security will be a serious challenge. This paper introduces the meaning characteristics and development present situation of cloud computing, and gives the analysis about the advantage of using cloud computing technology to spatial data management. The paper puts forward a spatial data security management model under the cloud environment, and summarizes the key security technologies of the spatial data storage and management.

Introduction

At the information age, along with the computer science and the rapid development of network technology, all kinds of mass data appears constantly. The speed of the orders of magnitude increasing is hard to imagine, which is from former GB, TB level to today's PB level or even greater. Especially spatial data gets the attention of people by its special structure and storage, and it's a great challenge to the data storage and management undoubtedly.

With this opportunity, appearing of Cloud Computing lets people immediately shine at the moment, which has the huge amounts of storage capacity, and the calculation of elastic that can change capacity to be solve mass data management and application of effective way. At the same time, it also can play out the value of the network resources and advantages. But the development of cloud computing is not mature, the existing hidden security dangers become the main problems the broad professionals concerns.

The Summary of Cloud Computing

The Definition of Cloud Computing. So far the cloud computing is not accepted exact definition. Along with continuous research in cloud computing, the definition of which is in the dynamic change.

Baidu encyclopedia [1] gives the definition of cloud computing at present: it is a web based method, the sharing of software and hardware resources and information can provide the need for computer and other equipment in this way. The whole operation mode is just like the grid.

Cloud Computing-China [2] defined "cloud" as: Cloud Computing is the development of Distributed Computing, Parallel Computing and Grid Computing, or is the commercial realization of these scientific concepts.

The Characteristics of Cloud computing. Cloud computing is accepted by the enterprise and the technology IT passionately because of its enormous advantages. Its specific characteristics can be summed up in the following aspects [3]:

1) *The large scale of server.* "Cloud" has a certain scale, Google who is the earliest practicer of cloud computing, already has millions of servers. And the Amazon, IBM, Microsoft, Yahoo, have more than 50 ten thousand servers in the "cloud". So "cloud" can give users super computing power.

2) *Resources virtualization.* Cloud computing can provide service in different geographical locations and all sorts of terminals. The requested resource is a dynamic and invisible. When the applications run in “cloud” somewhere, the users need not consider what the exact location it is. Only there is a laptop or a mobile phone, you can realize our need through network service, even supercompute such task.

3) *High reliability.* “Cloud” takes advantage of the multiple fault-tolerant measures to ensure the high reliability of the service.

4) *Strong generality.* In the support of “cloud”, a variety of applications can be constructed. Computing clouds aim at the changes of the application. Yet different applications operation can be supported by the same “clouds”, which can save a lot of network resources.

5) *Expansibility.* Although application and user scale are in the unceasing growth, “cloud” scale can also use the dynamic expansion and satisfy these needs.

6) *Service according to the needs.* The cloud is just like running water, electricity, coal gas that billing. Therefore, users can purchase what they need. And it’s also more convenient for enterprise and business network resources management.

7) *Low prices.* “Cloud” can be made by very cheap node, so “cloud” has no burden of more and more high data center management cost. When users enjoy the low cost of “cloud”, the traditional system of resources utilization has improved at the same time.

8) *High popular degree.* Based on the network platform and computer technologies, more and more users start to understand and enjoy the service from cloud computing, which is convenience in daily life with all kinds of practical application.

The Advantage of Spatial Data Under the Cloud Environment. One of the most famous data management technology based on cloud computing is Google's BigTable [4] data management system. At the same time, Hadoop team is developing a similar open source data management module like BigTable. The way to manage massive spatial data by cloud computing has advantages in the following aspects:

1) *Rich Data Resource.* Resource sharing is the important target for us in information era, especially when some spatial data source is much scarce. The arrival of cloud computing brings the good solution to this problem. Through the computer network, we can get any spatial data, which stored on the network and satisfy the work and study requirements on-demand at any time and anywhere. Cloud computing provides a very good development environment and application environment.

2) *Low Cost.* Based on cloud computing the low cost distributed parallel computing environment is implemented, so the cost of data processing greatly reduces, especially for complex topology relation in GIS, space and time data.

3) *Updates Timely.* Usually, as the operator of the GIS spatial data processing, the spatial data that we can get may be collected probably a few days, months and even years ago. So the update of the data becomes the main concern by a lot of enterprise and the users. The spatial data based on cloud computing is able to update timely. In this way, the information which is reflected by the GIS spatial data and analysis can play a greater role.

4) *Shields the Ground Floor.* In the parallelism conditions, cloud computing will be able to use the original equipment to improve the large-scale data processing power and speed, not only ensure the fault tolerance ,but also increases nodes.

Hidden Dangers of The Spatial Data Based on the Cloud Computing

Invasion of the illegal users. Cloud computing brings users the quick operation, but also gives users the threat of information security. Users will face a risk at a place, where they can't control, when processing spatial data. It will skip the physical, logic and artificial control of the information by users' IT department. So, those who use cloud computing need to have fully understood of people who deal with spatial data. And information about administrators and technicians that service provider offers is also necessary.

Unclear data position. When users are using cloud computing service, they do not know where their own data stored. Because of the unique structure and storage of spatial data, users' data will be distributed in all over the world randomly under the cloud environment. They cannot ensure that data can store in designated location according to the needs of users.

Unclear data isolation. In the cloud computing system, all of users' data is located in the sharing environment. Encryption can play a role, but it's still not enough. Users should know whether the cloud computing providers can apart data away or not, and whether encryption service is designed and tested by experts or not. If there is something wrong with encryption system, all data will not be used. For example, many exams are over the Internet at present. It's necessary to take measures to apart test and the answer away. If the isolation of question bank and the answer cannot reach the standard, the safety of the exam will not guarantee.

Difficult data recovery. In cloud computing process, data and applications will go wrong without any backup. When the user data is in the process of operation, there is a sudden encounter such as emergency power. In this case, the user's data will not guarantee. Another problem is computer virus and lawlessness hacker intrusion. Cloud computing environment is attractive for illegal hackers, because cloud is such better place to hide malicious software! It makes the spatial data security face the great threat. As data storage location is not clear, once destroyed, data recovery cannot be mentioned and there can be no loss estimation.

Spatial Data Security Model and Technologies Based on Cloud Computing

Spatial Data Security Model. For many of the spatial data security issues, many experts at home and abroad have made a lot of experiments and researches. Relational database model [5] which achieves space safety management is the effective method.

The model mainly has the information collection and access validation two parts. Information collecting module is used to collect user identity information, and will transfer the effective information to access validation module at the same time. After access validation module receives information, it ensures user identity uniqueness through the database of cloud.

Figure 1 shows the whole process of spatial data security model.

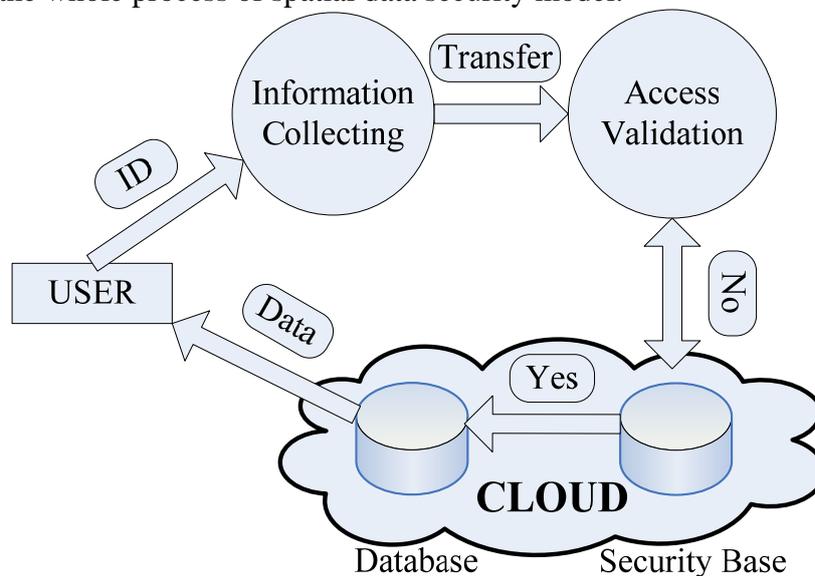


Fig. 1 Spatial Data Security Model

Spatial Data Security Technologies. Here are some main technologies for spatial data security..

1) *Save the spatial data for encryption.* Encryption technology can be used in the data encryption, only the correct password can be declassified. Encryption can protect your spatial data, including the data sent to the data center in the distance.

2) *The E-mail encryption.* E-mail can visit your inbox by the peeper style. In order to ensure that the E-mail security, you can use Hushmail or Mutemmail to encrypt all E-mails automatically.

3) *Use credit good service.* The reputable service is a good choice for spatial data users. They are unlikely to take risks with their famous brand. So the data won't be allowed leak occurs, also won't be shared with others.

4) *Business model in use.* Charge of Internet application service is safer than the free service. When you are choosing spatial data storage environment, paying storage is your first consider.

5) *Reading privacy statement.* When you store the data in the cloud computing environment, you must be sure to read the privacy statement. Because there are many leaks in privacy policies about Internet application, so some key data must be shared in some cases with your permission. So you can determine what spatial data should be stored in the cloud and what data should be stored in your computer [6].

Conclusion

Although cloud computing in spatial data storage and management, which is favor to many IT enterprise and user, has a lot of advantages. Generally speaking, cloud computing technology is still at the beginning stage. How to use cloud computing and make it gradually regularized, commercial and popular, needs a long process. The future is bright while the road ahead is tortuous; we have a long way to go!

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