

Research on Key Technologies of Medical Cloud for Medical Big Data Processing

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Abstract: Facing the demands of medical and health services and the opportunities and challenges of big data, traditional medical informationization cannot effectively cope with them. This paper designs a three-tier model of medical cloud for medical data processing, which integrates "cloud architecture" with the existing hospital information system perfectly by using private cloud of hospital, and establishes a new medical resource projection mode of "cloud service" hospital information system as service by using medical community cloud. And the medical data processing system can effectively use "cloud computing" to process and utilize medical data. With cloud computing as the brain, big data as the soul, hospital informatization as the carrier, based on cloud computing and big data core technology and concept, the application of medical cloud and big data is realized in stages under this model.

1. Introduction

Under the framework of traditional medical system, there are many unreasonable problems in hospital information construction. Firstly, for hospitals, the information system of hospitals is not always the focus of their business, but a tool for hospitals to realize their own medical business logic. Under the current architecture, hospitals have to invest a lot of manpower and material resources to build, manage and maintain various application systems in hospitals. At the same time, these systems need different independent software and hardware platforms, which make medical informatization itself heavy and complex. Secondly, the distribution of medical resources between regions and hospitals in China is unbalanced, most of the medical investment is concentrated between large hospitals, while the grass-roots hospitals with the same burden of serving patients do not have enough funds to build their own medical information system, nor do they have enough talents with professional IT literacy to manage and maintain. Finally, unreasonable hospital information system architecture and unreasonable distribution of medical resources also lead to the non-sharing and non-centralization of clinical business data, which will lead to the huge medical value of clinical business data cannot be used reasonably and effectively.

With the arrival of the era of big data, these unreasonable factors make the secondary utilization of big medical data into a huge dilemma. Therefore, it is urgent for medical institutions to change the traditional mode of hospital informatization construction from the perspective of architecture, and introduce the core technology and service mode of cloud computing into hospital informatization construction.

2. Key technologies of medical cloud and medical big data

2.1. Definition and characteristics of cloud computing

Cloud computing includes five basic features: On-demand Self-service, Broad network access, Pooling Resource, Rapid Elasticity, Measured-service, as shown in Figure 1 below.

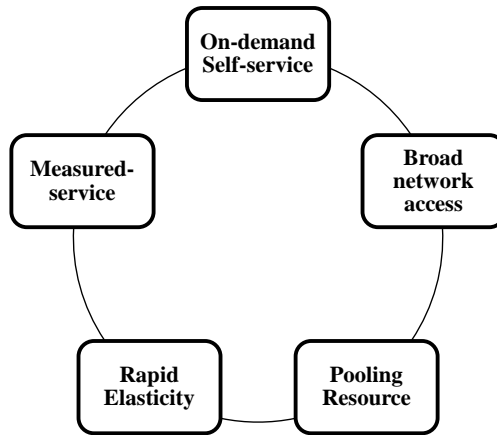


Figure1. Cloud computing basic features

2.2. Hadoop ecosphere

At present, the design of large data processing system is divided into two directions: centralized computing and distributed computing. The commonly used distributed large data processing platforms are Hadoop, Spark and Storm. Hadoop, an open source project under the Apache Foundation, is a distributed software framework that can provide PB-level data storage and processing through a Linux cluster. DFS is a distributed file system based on Hadoop platform, which has many similarities and unique characteristics compared with other common distributed file systems. The feature of HDFS is that it can achieve high fault tolerance on cheap hardware. HDFS is suitable for large data applications and provides high throughput data access capability. The HDFS architecture is shown in Figure 2.

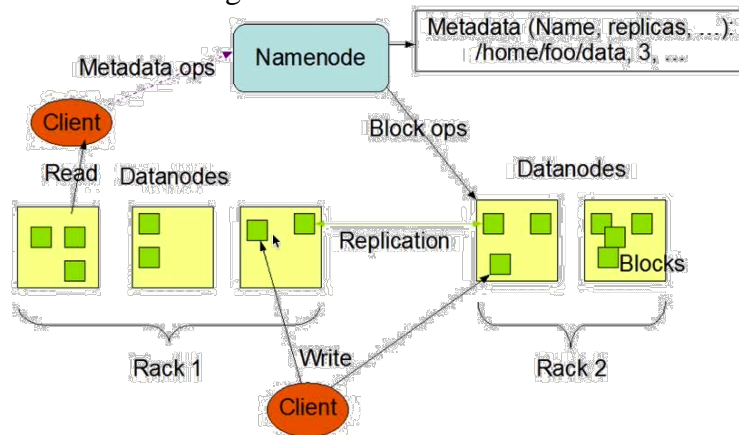


Figure2. HDFS architecture

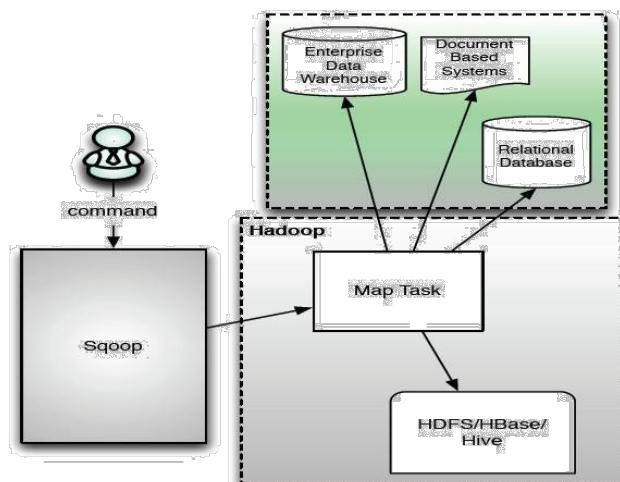


Figure3. Sqoop working principle

Sqoop is a tool for effectively transferring batch data between Hadoop and structured data sets. Because Sqoop supports MapReduce jobs to speed up the efficiency of data import and export of HDFS, we can develop tools for extracting, transforming and loading large data through Sqoop API. Its working principle is shown in Figure 3.

3. Medical cloud based on virtualization technology

3.1. Design of hospital medical cloud

The overall architecture of hospital private cloud is shown in Figure 4.

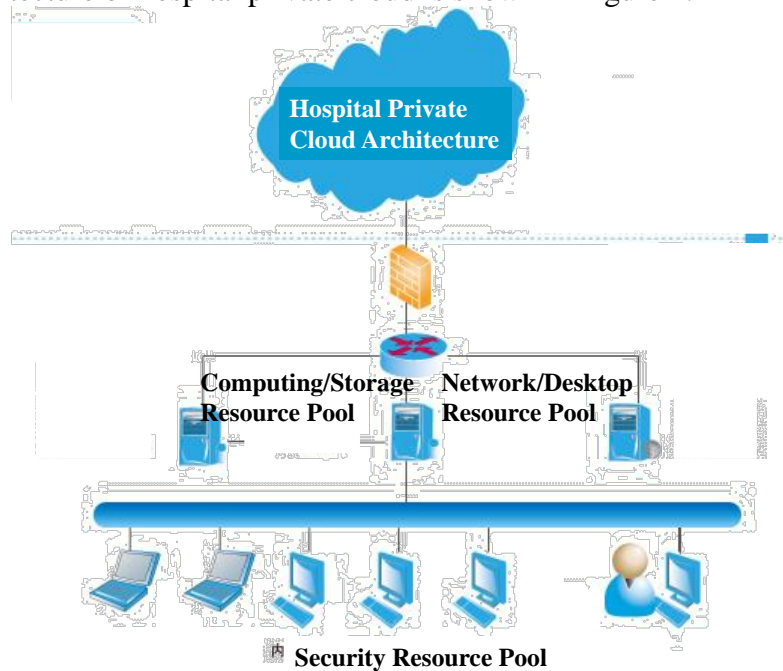


Figure 4

Based on the concept of "pool", through virtualization, load balancing and high availability technologies, hospital information resources are highly integrated and fully utilized to construct five virtual IT resource pools. It realizes the new environment of system unified deployment, resource allocation on demand and data security sharing in the platform, improves the overall utilization rate of IT resources, gives full play to the efficiency of information system, and comprehensively solves the problems existing in the traditional hospital IT construction framework.

3.2. Hospital private cloud performance assessment

The performance and user experience of hospital information system directly affect the work efficiency and medical process of system users, and indirectly affect the quality of medical services. The hospital information system based on hospital private cloud has not changed in user interface and operation habits. Its direct function is the interaction mode between servers of hospital information system and between clients and servers of hospital information system. Under the traditional hospital IT architecture, the relationship between server and client is one-to-many. The data transmission between server and client depends on the network bandwidth between them. At the same time, the load capacity and concurrency capacity of single server are limited. Under the new private hospital cloud architecture, all data interaction is carried out through the network resource pool between the cloud production cloud and desktop cloud. The network bandwidth requirement between the client machine and the cloud is minimal. After resource pooling, with the improvement of the overall performance of the system and the free and reasonable scheduling, the load capacity and concurrency capacity of the server side have been improved.

4. Conclusions

In the era of big data, the medical industry is one of the main growth areas of big data. Big medical data is both an opportunity and a challenge for medical informationization. Exploring the intrinsic value of big medical data has immeasurable significance for the health problems of the whole human society, and is also conducive to the development of medical informationization itself. Based on the key technologies and core concepts of cloud computing and big data, this paper designs a three-tier medical cloud model for big data processing. Based on this model, the medical private cloud, medical community cloud, medical cloud service and medical big data processing system are designed and implemented in stages. Finally, the medical cloud oriented to medical big data processing is designed and implemented, which solves the problem of medical big data in the application process of medical cloud.

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