On Study of Application of Big Data and Cloud Computing Technology in Smart Campus

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Abstract: We live in an era of network and information, which means we produce and face a lot of data every day, however it is not easy for database in the traditional meaning to better store, process and analyze the mass data, therefore the big data was born at the right moment. Meanwhile, the development and operation of big data rest with cloud computing which provides sufficient space and resources available to process and analyze data of big data technology. Nowadays, the proposal of smart campus construction aims at improving the process of building information in colleges and universities, therefore it is necessary to consider combining big data technology and cloud computing technology into construction of smart campus to make campus database system and campus management system mutually combined rather than isolated, and to serve smart campus construction through integrating, storing, processing and analyzing mass data.

1. Introduction
In recent years, major colleges and universities are strengthening information construction of campuses, and however, most of them walk on the beaten track for information construction in the traditional meaning. Although they develop and apply a number of educational management systems and database systems, these systems are independent and irrelevant in structures. Although they have improved the information construction of colleges and universities to some extent, serious block problems are still existed in function and logic, which is harmful to integrate and analyze data. This is an era filled with mass data whose operation lies in assistance of big data technology, and the cloud computing is experiencing rapid development at the same time, therefore it is a problem we need to consider about how to apply big data technology and cloud computing technology into campus information construction.

2. Introduction of Big Data and Cloud Computing

2.1 Big Data Technology
Big data is a hot topic in recent years, and the so-called big is just a relative concept. The reason that big data is also known as massive data or vast amount of information is that it involves such large scales of amount that the current mainstream data processing software tools are incapable of acquiring, managing and processing information in a reasonable time and collecting it to assist enterprises in business decision-making. The big data technology is characterized by volume, velocity, variety and veracity, and large number of data can be processed effectively only through special technologies [1]. Technologies capable of processing big data include data mining, distributed databases, distributed file system, massively parallel processing database, cloud computing platform and extensible storage systems and the internet [2].

The reason that the Big data emerges as a proper noun is mainly that with rapid development of
internet, the internet of things and cloud computing in recent years, data are produced all the time by ubiquitous mobile devices, wireless sensors and FRID; meanwhile, hundreds of millions of internet users enjoy internet services, and they also produce a huge amount of interactive data at all times. This situation shows that a huge amount of data need to be processed and develop rapidly with the speed beyond imagination; as for enterprises, a higher and new requirement of effective and real-time data processing is proposed out of competition pressure and business needs, which is unrealistic for previous data processing means, therefore the big data technology is born at the right moment.

The big data can be seen as a database of massive data, and an observation of development in big data field shows that the current big data processing develops toward experience of similar traditional database all the time; the production of Hadoop realizes our idea that general machines can be used to establish a stable cluster processing TB level data, meanwhile, it also witnesses parallel computing; however Map Reduce is not suitable for application of data analysts due to its complexity, therefore the Hive appears which is an operation mode similar to SQL.

2.2 Cloud Computing Technology

Cloud computing is an outcome of combination of computer development and traditional network technologies including parallel computing, distributed computing, high available, load balance, utility computing and network storage technologies. It means these computer concepts are commercialized, and cloud computing is the product and reflection of commercialization. Serving as a supercomputing model based on internet services, cloud computing collectively processes large amount of data and resources stored in personal computers, mobile devices, and large servers, and then provides service availability for external users.

![Figure 1: Processing Ranges of Cloud Computing](image)

Cloud computing is also another great change when the mega-computer changes to the Client-Server model since the twentieth century. We compare the internet and network as cloud which, in return, is an abstract expression of internet and the underlying infrastructure. Therefore the cloud computing allows us to experience the supercomputing ability of 10 trillion times per second, which means such a powerful computing ability is fully able to predict climate changes, market development trends and even simulate nuclear explosion scene.

The cloud computing can be defined on narrow sense and broad sense. On narrow sense, the cloud computing mainly refers that manufacturers are able to establish supercomputers or data centers through virtualization technology and distributed computing, and then to provide functional services like data storage, analysis and scientific computing for business users or technical development staff through on-demand rent way or free way; a famous example is the Amazon data books warehouse rental. Broadly, the cloud computing refers that manufacturers are able to provide different needs of service including hardware rental, computing analysis, online software services and data storage for different customers through creating a network server cluster; a successful cases is program issued by
Google - Google Apps suite. In fact, "cloud" here refers to software and hardware resources available on clusters of network servers, and software resources include integrated development environment and related application software, while hardware resources include CPU, server and memory \([3]\). Users just need to send a demand message over the internet on the local computer, and there is nothing to do on local computer because there are tens of thousands of computers available to us at the far end to provide us with resources we need, and they will return the results to our local computer, and these processes will be completed on network server cluster provided by the cloud computing manufacturer.

| Characteristic                          | Description                                      |
|----------------------------------------|--------------------------------------------------|
| Data in the cloud                      | No fear of missing, no need for backup and restoration at any point |
| Software in the cloud                  | No need for download and automatic upgrade       |
| Ubiquitous calculations                | Cloud computing at any time, any place, any equipment after login |
| Infinite powerful calculation          | Endless space and infinite speed                 |

Cloud computing system integrates a wide range of technologies, of which key technologies are data management technology, cloud computing platform management technology, programming model, virtualization technology and data storage technology \([4]\).

| Technology                              | Introduction                                                                                                                                                                                                 |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data management technology              | Cloud computing needs to process and analyze distributed and massive data, therefore, the data management technology must be able to efficiently manage large amount of data. The data management technology in cloud computing systems refers BT (Big Table) data management technology of Google and open data management module H Base developed by Hadoop team. |
| Cloud computing platform management technology | Platform management technology of cloud computing system can make a large number of servers work together, facilitate business deployment and development, rapidly detect and recover system failure and operate large-scale systems through automated and intelligent means. |
| Programming model                       | Map Reduce refers a java, Python and C++ programming model developed by Google. It is a simplified distributed programming model and an efficient task scheduling model for parallel computing of large-scale data sets (greater than 1TB). |
| Virtualization technology               | The software application shall be separated from underlying hardware by virtue of virtualization technology which can split single resource into the split mode of multiple virtual resources, or integrate multiple resources into a virtual resource aggregation mode. Virtualization technology can be divided into storage virtualization, computing virtualization and network virtualization according to different objects, and computing virtualization here is divided into system-level virtualization, application-level virtualization and desktop virtualization. |
| Data storage technology                 | Cloud computing system consists of a large number of servers and serves a large number of users, therefore the cloud computing system stores data by adopting distributed storage method, and ensures data reliability with redundant storage method. Systems widely applied in the cloud computing are Google's GFS and open HDFS of GFS developed by Hadoop team. |

2.3 Relationship between Big Data Technology and Cloud Computing Technology

In short, big data can be seen as a highly efficient processing of massive amount of data, while cloud computing is a virtualization of hardware resources. An observation of development trend in the future shows that cloud computing will serve as the bottom of computing resources to support big data processing in upper layer, and big data in the future will focus more on enhancing the ability to analyze data and improving real-time interactive query efficiency.
3. **Smart Campus**

Smart campus refers to the intelligent environment where learning, life and campus work are integral with internet of things as a basis and various types of application service system as carriers, and integrates campus life, research, teaching and school management. The "Smart Campus" was initially proposed by Zhejiang University in the information "12th Five-Year Plan", and it depicts a network research integrating innovation, ubiquitous network learning, colorful campus culture, transparent and efficient school governance as well as convenient and thoughtful campus life [5]. Simply, it aims at building a green, energy-saving, stable and safe campus.

The construction of smart campus lies in support of technology of internet of things; according to IDC's latest data forecast, by 2020, there will be 31 billion internet devices networking worldwide, and people will experience ubiquitous internet service at that time [6]. The construction of smart campus is able to connect objects in campus by virtue of technology of internet of things, which is mainly related to two-dimensional code, FRID, video surveillance and other sensing equipments and technologies.

![Figure 2: Structure and Function of Smart Campus](image)

The main objectives and functions of smart campus are as in three aspects: first, it provides teachers and students for a comprehensive information service platform and an intelligent and comprehensive perception environment; it provides personalized service according to the different roles of teachers and students; secondly, information services realized only through computer network will better integrate into various service areas in campus including online and offline services, and then achieve online and offline efficient cooperation and interconnection; finally, a bridge between campus and external environment will be built by virtue of this integrated information service platform and intelligent perception of environment so as to realize mutual communication, mutual perception and development.
4. Application of Big Data and Cloud Computing Technology in Smart Campus

The smart campus introduces relevant sensors or equipments into the relevant objects in the campus including office space, classrooms, laboratories, cafeterias, dormitories, libraries, gymnasiums, mobile terminals and others, then forms the internet of things by virtue of internet, finally integrates internet of things and existing digital campus network resources by combining big data technology and cloud computing technology as well as other related technologies to achieve interconnection of campus information intelligent education and management model.

Smart campus is also the product of IOT, Internet and intelligent terminal technology, and it can be defined an integral environment equipped with intelligent management and analysis function. It reflects characteristics of campus through sharing information and systematically analyzing data [7]. The application of big data technology in smart campus is mainly in following aspects.

| Application of | Serving as an important part of information technology, IOT is the product of the era of information; Internet is the core and foundation of IOT which is the expansion and extension of internet, and its client extends to information exchange and communication of any two items. |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IOT           | Cloud Computing (hereinafter referred to as CC) is the product of computer and network technology integration, and is characterized by high reliability, versatility and low price; the application of CC service platform in smart campus construction reflects wisdom in campus. |
| Cloud Computing | In smart campus, Intelligent Sensor is frequently used in smart classroom. The smart classroom reflects refinement of teaching management, mainly involves in monitoring and regulation of classroom environment, as well as emotional perception and analysis of teachers and students in classroom; it collects and analyzes relevant information from two aspects of object and human. |
| Intelligent Sensor | Campus one-card is widely used in many campuses with its own convenience, and its core technology is big data technology. |
| One-card | In smart campus, effective combination of big data and the internet builds a network communication platform by which students are able to learn from each other. |
| Social networking platform | A campus cloud system can be built through cloud computing and virtualization technology, and connected with technology of internet of things so as to jointly build a smart campus system. The cloud computing can be used to build an educational cloud platform where teachers and students can share educational and educational details. This tends to not only enhance interaction between teachers and students in teaching, improve acceptability and intuition of educational details, but also stimulate...
students' interest in autonomous learning; similarly, the education system also helps school information system to integrate and manage information. Cloud computing technology is applied in constructing smart campus in following three aspects.

| Digital library | The integrated library management platform can be built with RFID smart label technology as the direction to achieve automatic book inventory, book self-borrowing, book area positioning and development of intelligent navigation system. |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Smart safe campus | The construction of campus digital monitoring system is able to gradually integrate existing simulation monitoring system into digital and integrated intelligent security platform while supporting flexible and distributed security monitoring mode, multi-level rights management, wireless, internet, intelligent terminal and other monitoring modes, intelligent analysis and early warning of monitoring images, as well as data mining of monitoring images. |
| Green, energy saving and smart campus | The application of intelligent sensing technology and information technology is able to conduct real-time monitoring, intelligent analysis, optimal scheduling and management and control to various campus energy-consuming equipments so as to achieve energy-saving emission reduction and low-carbon environmental protection, to reduce campus operating costs, and to construct conservation-oriented green campus. |

5. Conclusions
This chapter begins discussion by centering on how to apply big data technology and cloud computing technology into smart campus; in this era of big data, the processing of massive data processing lies in big data technology, meanwhile, cloud computing technology is also indispensable for us in the Internet age and is the underlying support of big data technology, which provides available space and resources for processing massive data. The analysis and processing assist in constructing smart campus, and only by efficient and rapid processing of data generated will smart campus be better constructed. Information construction will be accelerated in colleges and universities by combining big data technology and cloud computing technology, and applying them into construction of smart campus.

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Reference
[1] Wang Xiaoguang, Du Nuannan, Zhang Shaolong, Wang Cong, Li Na. On Study of Application of Big Data and Cloud Computing Technology in Smart Campus[J]. Computer CD Software and Applications, 2014, (08): 235-237
[2] Ma Xiaoping, Hu Yanjun, Miao Yanzi. On Study of Application of Internet of Things, Big Data and Cloud Computing Technology in Coal Mine Safety Production[J]. Industry and Mine Automation, 2014, (04): 5-9
[3] Zong Ping, Zhu Hongbo, Huang Gang, Xu Jianzhen. On Study of Design Methods of Smart Campus[J]. Journal of Nanjing University of Posts and Telecommunications (natural science edition), 2010, (04): 15-19
[4] Du Yansui. On Study of Smart Campus Construction Based on Cloud Computing Technology[J]. Journal of Liaoning Administration College, 2016, (11): 93-96
[5] Lin Xihui. On Study of Application of Smart Campus Construction Based on Cloud Computing Technology[J]. Guangxi Education, 2014, (07): 190-192
[6] Li Zheng, Wang Lu. On Study of Application of Cloud Computing Technology in Smart Campus[J]. Computer and Modernization, 2012, (05): 48-50
[7] Guo Ping. On Study of Application of Cloud Computing in Smart Campus[J]. Practical Electronics, 2015, (12): 149-150