Design and Realization of Webpage Operation Computer System Based on Cloud Computing

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Abstract. In recent years, our country’s computer industry has developed vigorously. With people’s increasing demand for computer service data processing capabilities and computer operating system portability and cross-platform requirements, traditional computers are no longer competent, and there will always be calculations. Speed cannot take into account portability and cross-platform, the embarrassing situation that computing speed cannot meet the standard for portability. And now is the time for the rapid development of the Internet industry, and the development of network speed has promoted this new model of Cloud Computing(CC). CC is a network-based shared computing resource pool service model with on-demand access and capacity expansion. It is one of the solutions for massive data storage and processing, large-scale concurrent operations and other services. In order to solve the awkward situation between portability and performance in the computer field, this paper designs a web-based computer system based on the CC model to provide private cloud and public cloud services to individual users and corporate users, encapsulate the underlying services, and implement the system. The unique system application framework provides interfaces to third-party developers while implementing the background system. Webpage operating systems try to gradually transform CC from concept to materialization. CC's on-demand services, on-demand access, independent resource pool division, fast flexibility, and measurable access are integrated. After system performance testing and a period of online public testing, the implementation of web-based cloud operating system and system performance have been guaranteed.

Keywords: Cloud Computing, Cross-Platform, Operating System, Computer Service
1. Introduction

In recent years, various technologies such as distributed storage, distributed computing, and virtualization in the computer field have shifted from theoretical research to commercialization, which is sufficient to realize the basic requirements of "change on demand" in the field of CC [1-2]. As the pillar technology of CC development, its core technologies such as hardware performance, distributed computing, parallel computing, virtualization technology, multi-tenant architecture, mass storage technology, automatic management and deployment have developed rapidly [3]. Its basic mobile Internet environment such as high-speed networks (4G, 5G networks), Wifi everywhere, diversified terminal equipment, integrated data center, Web technology, etc. also have the ability to realize the concept of CC[4]. At present, in the ever-changing and complex social environment, no means or method can accurately predict the occurrence of the black swan phenomenon (it was impossible to predict before, and it was impossible to derive the exact cause after it happened). The real-time acquisition and comprehensive analysis of information will help to manage the complex and varied computing resources and complex and changeable business processes, and effectively reduce the adverse interference of the black swan phenomenon [5]. The real-time, network-wide, and on-demand characteristics of CC bring particularly considerable value on this basis [6].

Due to the huge business opportunities brought about by the booming development of CC, many companies have begun to develop CC services. Large companies such as Goolge, Amazon, IBM, Microsoft, and Yahoo are leading the field in CC. Many successful companies include VMWare, Salesforce, Facebook, YouTube, etc.[7]. Based on the Window operating system, Microsoft puts forward the "heavy" client model of CC, puts forward the CC concept of "cloud + terminal", emphasizes the importance of "terminal" in CC, and launches the Windows Azure operating system. After Azure is a DOS and Windows system, Microsoft launched a system with major reforms and designed a new CC platform based on the Internet. Azure is a technology deployed on the side of CC server clusters. It provides developers with overall solutions through server clusters, thereby bringing the idea of CC to the ground. Azure can be used on the Internet or called by local systems. Azure uses the underlying services of Microsoft's global basic service system and consists of fourth-generation data centers all over the world. Another example is Google’s Chrome OS, whose kernel is implemented based on the Linux system, which is also an emerging operating system. The core of its design is networking, which will network all users' usage. The design and implementation of Chrome OS is worth learning from the terminal operating system. Chrome OS has its unique characteristics and advantages, but at the same time it also has a lot of shortcomings that limit its functions. Chrome OS uses cloud services to process user requests, and all user information is stored in the cloud, which is consistent with the cloud terminal operating system of the paper. Chrome OS has done a lot of processing on the hardware, so that the system speed has been greatly improved, especially the use of firmware has greatly guaranteed the security of the system. Although the design ideas of Chrome OS and cloud terminal operating systems are very similar, they also have certain research value and practical significance. However, it is subject to more restrictions and not easy to expand. As a commercial product, it pays more attention to benefits and does not play a big role in the development of the operating system concept.

This article studies a web operating system based on CC. In addition to the functions of storing files and running programs in the local operating system, it also solves the inconvenience of file use, poor versatility between different devices, low efficiency of collaborative office, and long application
upgrades. High hardware cost, long application program construction time, unstable operating environment and other issues [8]. The webpage operating system runs in a server cluster anywhere in the world. You can log in to the system and use the personal data and various types stored in the system through a browser on a personal computer, tablet, smart phone and other smart devices that can be connected to the Internet. application. The system can complete application upgrades that users do not perceive during operation. The upgraded application can be deployed in the server cluster and redirected to complete the application upgrade. The user only needs to log in to the system to use the upgrade directly. After the application, with the technical support of virtualization and load balancing, the system no longer needs high-performance computers. When processing large-scale and massive data, you only need to hand over the processing work to the background server to complete. Different types of servers and even desktop computers can be formed into a server cluster. One or several virtual machines of a single server provide processing power to small applications, and virtual machines in multiple servers provide processing power to a large application. Make full use of the storage capacity, computing power, and import and export bandwidth of each single device in the server cluster, while solving the problem of increasing the number of servers on demand.

2. Method

The following are some technologies related to cloud computing and operating systems, including cloud computing architecture, distributed storage, virtualization, and distributed management.

CC architecture: CC is a mode that allows convenient and on-demand access to network-based, configurable shared computing resource pools[9]. These configurable shared resource computing pools include networks, servers, storage, applications, and services. And these resource pools can be quickly provided and released with minimal management or through interaction with service providers. Such a cloud model improves availability and has excellent features such as on-demand self-service, access anytime, anywhere, virtual closed resource pool, fast elasticity, and measurable services.

Distributed storage: The main method of CC to store data is distributed storage, and redundant storage is used to ensure the high reliability and availability of data and materials, which also ensures the economy of the CC system from the perspective of resource utilization. In addition, CC systems must meet the basic needs of users and provide storage services for their users at the same time. Therefore, CC data storage technology needs to meet the characteristics of high throughput and transmission rate. The following is the calculation formula for related storage specifications:

Random IOPS performance calculation formula:

\[ IOPS = 1800 + (\text{GB}) \times 50 \] (1)

IOPS represents the maximum random energy, and GB represents the storage capacity.

Throughput performance calculation formula (MB/s):

\[ \text{MTH} = 120 + (\text{GB}) \times 0.50 \] (2)

Among them, MTH stands for throughput performance, and GB stands for storage capacity.
Virtualization: Virtualization is the most important technical basis for CC. Virtualization technology realizes the logical abstract representation of physical resources[10]. Virtualization technology can improve the utilization rate of IT resources, and can quickly allocate resources according to changes in user needs. Virtualization is a broad technical term that refers to abstracting computing resources or computing environments. Virtualization provides a platform to logically present physical computing resources to the operating system running on it. In this way, multiple operating systems share a physical computer device at the same time, and they think that they also have exclusive control over the physical device. Virtualization also modifies some real attributes of physical resources, turning them into a general logical resource and presenting it to the operating system. Virtualization technology is to encapsulate and hide specific technical characteristics, and provide a unified logical interface to the outside, thereby shielding the differences caused by the diversity of physical devices. Among them, the virtualization calculation formula is as follows:

CC vCPU resource calculation formula (MHz):

\[ vCPU = N \times H \times X \times P \]  \hspace{1cm} (3)

Among them, vCPU represents CPU resources, N represents the number of CPUs, H represents the number of CPU cores, X represents the number of CPU single-core threads, and P represents the CPU frequency.

Distributed management: At present, the data management technology in the CC system is mainly composed of Google's BigTable data management technology and the open source data management module HBase developed by the Hadoop team. BigTable is a large-scale distributed database based on the GFS and MapReduce framework. It treats all data as objects and integrates them into a super-large data table to distribute and store large-scale structured data. The characteristic of CC is the storage of massive amounts of data. The read and write operations of files are far greater than the update frequency of files. CC data management takes read and write data management as the primary task. Therefore, the data management of the CC system usually uses the data management mode of database column storage, and the data table is divided into columns and stored. The three main components of BigTable are the library connected to all clients, the main server, and the record server. The main server is responsible for allocating recording servers, load balancing, etc. The recording server mainly handles read and write operation requests. To ensure the high scalability of the data structure, BigTable uses a three-level hierarchical way to store location information.

In the design of web operating system based on CC, many related concepts and technical points are involved. The system must have the corresponding characteristics of CC in the field of CC. At the same time, the system can be analyzed from different angles. Virtualization technology is the basis for realizing CC clusters. It completes the construction of resource pools and ensures the utilization of hardware resources. Distributed storage of massive data is the core technology of the file system part of the system, which provides a solution for remote storage of massive data. The parallel programming model guarantees the operating efficiency of the system under large concurrency. Mass data management technology ensures the query efficiency of the system in the case of a large database. Load balancing technology ensures the rapid response of the system and high network resource utilization in the case of high concurrent requests.
3. **Experiment**

3.1. **Purpose of the Experiment**

This paper is based on the theoretical results of CC, draws on the domestic and foreign theoretical research results, uses literature, comparative research, mathematical statistics, logical analysis and other methods to conduct in-depth analysis from the CC webpage operating computer system, and research based on CC The advantages of the web page operating computer system and the ease of use, cross-platform and acceptability in life.

3.2. **Experimental Design**

This article conducts experiments from the perspectives of computing speed and portability. After designing and developing a CC-based web operation computer system, the following experimental plans are formulated:

1. Run a specific program on an ordinary computer (Windows operating system), mobile phone (Android), and CC-based web operating system, and judge its performance by calculating time;

2. After introducing the system rate characteristics to some users of CC-based webpage operating computer systems, let them use ordinary computers or this operating system in their study, office, and life, and judge the portability and public acceptance of the system by the frequency of use Sex.

4. **Result**

4.1. **Performance of the Cc Webpage Operating Computer System**

After statistical analysis of the data in Experiment 1, it can be clearly seen that the CC-based webpage operating computer system has portability and cross-platform capabilities, and its computing performance is also sufficient to meet the requirements. The specific data is shown in the following table (the research system in this article is represented by WebOS):

| Group | Platform | Operating System | Program Execution Time(s) |
|-------|----------|------------------|---------------------------|
| 1     | PC       | Windows 10       | 10                        |
|       | Phone    | Android 10       | 50                        |
|       | Web OS   | Web OS           | 14                        |
| 2     | PC       | Windows 10       | 11                        |
Through statistical analysis of the data of Experiment 2, because the webpage operating computer system has very good cross-platform characteristics, it can be used on any platform, which undoubtedly improves system compatibility and user acceptance of it. The specific data is as follows (the system in this article is represented by WebOS):

| Platform | Operating System | Execution Time |
|----------|------------------|----------------|
| Phone    | Android 10       | 49             |
| Web OS   | Web OS           | 12             |
| PC       | Windows 10       | 9              |
| Phone    | Android 10       | 54             |
| Web OS   | Web OS           | 10             |

**Figure 1. Average Execution Time**

**4.2. Acceptability of Cc Webpage Operation Computer System**

Table 2. Operational compatibility and user usage times
| Group | Platform     | PC | UsageCount | Phone | UsageCount |
|-------|--------------|----|------------|-------|------------|
| 1     | Windows 10   | T  | 5          | F     | /          |
|       | Android 10   | F  | /          | T     | 10         |
|       | Web OS       | T  | 15         | T     | 10         |
| 2     | Windows 10   | T  | 6          | F     | /          |
|       | Android 10   | F  | /          | T     | 9          |
|       | Web OS       | T  | 14         | T     | 11         |
| 3     | Windows 10   | T  | 4          | F     | /          |
|       | Android 10   | F  | /          | T     | 8          |
|       | Web OS       | T  | 16         | T     | 12         |

**Figure 2.** Every device user usage times

5. Conclusion

CC is a mode that provides convenient and on-demand access to network-based and configurable shared computing resource pools. It is one of the solutions for massive data storage and processing, large-scale concurrent operations and other services. With the development of computers and the Internet, CC has gradually changed from concept to materialization, and CC services on demand. The characteristics of service, network access, independent resource pool division, rapid flexibility, and measurable access have gradually become accepted. The delivery model of CC can divide CC into three layers: IaaS (infrastructure as a service), PaaS (platform as a service), and SaaS (software application as a service). The webpage operating system involved in this article implements CC related concepts and provides
PaaS and SaaS services. This article gives a detailed description of the overall architecture design, back-end design and architecture of the webpage operating system, narrates the requirements, design and implementation of each module of the system, and also gives the server cluster construction and system application framework implementation.

References

[1] Zhang Miao, Peng Yong, Yang Mei et al. A discrete PSO-based static load balancing algorithm for distributed simulations in a cloud environment[J]. Future Generation Computer Systems, 2021, 115:56-70.

[2] Loren Peitso, Don Brutzman Defeating lag in network-distributed physics simulations[J]. Graphical Models, 2020, 111:18-20.

[3] Attarzadeh-Niaki Seyed-Hosein, Sander Ingo, Ahmadi Mohammad An automated parallel simulation flow for cyber-physical system design[J.] Integration, 2021, 77:156-163.

[4] Engineering - Construction Engineering; University of Alberta Details Findings in Construction Engineering (Distributed Simulation-based Analytics Approach for Enhancing Safety Management Systems In Industrial Construction)[J]. Journal of Engineering, 2020:574-580.

[5] Engineering - Maritime Engineering; Study Findings on Maritime Engineering Are Outlined in Reports from Defence Research and Development Canada (International Development and Validation of a Distributed Simulation for Naval Ship Replenishment At Sea)[J]. Journal of Engineering, 2020:23-40.

[6] Aerospace Research - Aerospace Computing; Data on Aerospace Computing Detailed by Researchers at Technical University (DO-330/ED-215 Overlay to the IEEE Recommended Practice for Distributed Simulation Engineering and Execution Process)[J]. Journal of Engineering, 2018:97-99.

[7] Information Technology; Reports from University of Central Florida Advance Knowledge in Information Technology (Multiple Resolution Modeling: A Particular Case of Distributed Simulation)[J]. Information Technology Newsweekly, 2020:145-147.

[8] Information Technology - Data Centers; Investigators at NUST Discuss Findings in Data Centers (Locality-aware process placement for parallel and distributed simulation in cloud data centers)[J]. Computer Technology Journal, 2019:38-49.

[9] Leidos, Inc.; Researchers Submit Patent Application, "Methods and Systems of Dynamic Management of Resources in a Virtualized Environment", for Approval (USPTO 20170063978)[J]. Computer Weekly News, 2017:63-70.

[10] Adam Bales Richness and rationality: causal decision theory and the WAR argument[J]. Synthese, 2018, 195(1):369-372.