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Cloud Computing Standardization: Fueling Digital Economy Industry Advancements

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Abstract: In recent years, China's information technology sector has witnessed rapid growth. The development landscape of cloud security, storage, servers, and data centers, all linked to the cloud computing industry, has seen continuous expansion. The significance of cloud computing standardization in driving the development of the digital economy industry has grown notably. This article aims to present the fundamental concepts of cloud computing, provide an overview of its application in fostering the digital economy industry, analyze the current status and principal challenges in cloud computing standardization research, explore strategies for leveraging cloud computing standardization to empower the digital economy industry and offer a range of application scenarios. The goal is to summarize experiences and offer valuable reference material for relevant stakeholders.

Keywords: Cloud computing; Standardization; Digital economy; Industrial development

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1. Introduction

China has entered a new stage of economic development with the information industry at its core. The scale of the digital economy industry continues to expand and has become a new engine for China's economic and social development. Cloud computing, as an intelligent and data-driven infrastructure, can swiftly analyze and process massive data, offering high-quality network services across various industries. In the era of the digital economy, cloud computing standardization has the potential to empower the digital economy industry, revolutionize its development model, and consequently promote the stable and healthy growth of China's economy.

2. Basic concepts of cloud computing

Cloud computing falls under the category of distributed computing. Its primary feature involves breaking down extensive data computing processing programs into multiple smaller programs through the "cloud" of the Internet. Subsequently, a system comprised of multiple servers is used to analyze and process the results of these smaller programs, providing relevant information to the user [1]. The author asserts that cloud computing

is a network capable of providing a variety of resources. Within this network, users can readily access resources in the "cloud" as needed. Furthermore, cloud computing is a service connected to software, the Internet, and information technology. It can utilize a shared pool of computer resources within the "cloud" to aggregate multiple computer resources through cloud computing. This allows for the automatic management of resources using software, facilitating swift and secure data storage and cloud computing services. Simultaneously, cloud computing can expedite the transformation of traditional IT businesses. Users can address complex and diverse underlying IT architecture and perform tasks such as development, operation, and maintenance, all conducted via the Internet, shared data storage, and software services.

3. Overview of the application of cloud computing in the development of digital economy industries

Currently, cloud computing application models encompass Platform as a Service (PaaS), Software as a Service (SaaS), and Infrastructure as a Service (IaaS). Foreign markets predominantly favor SaaS as the primary model, along with the underlying IaaS framework. While this model offers substantial advantages, further research is needed to assess its compatibility with the centralized architecture of governments and enterprises. Additionally, China's cloud computing and related technologies are still in development, necessitating ongoing adjustments and enhancements. To cater to enterprises' demands for sensitive data resources, it is imperative to bolster technology research and development while promoting a model that combines public and private clouds. This involves continuous expansion of the public cloud SaaS industry, optimizing user experiences, automating maintenance, and ensuring smooth private cloud upgrades. In doing so, cloud computing can more effectively empower the digital economy [2]. Furthermore, the development of cloud computing hinges on robust security services. This entails reinforcing infrastructure, including networks, storage, and servers, actively developing cloud security services, and enhancing traditional security tools.

4. Current status and main problems of cloud computing standardization research

4.1. Current status of cloud computing standardization research

Most Western developed countries have devised cloud computing development plans, with research institutions, enterprises, and communities collaboratively advancing critical technology research. Over years of development, cloud computing has yielded favorable results in finance, healthcare, education, government affairs, and small to medium-sized enterprises [3]. Organizations such as the Distributed Management Task Force, the Open Cloud Computing Alliance, the Cloud Security Alliance, and the International Organization for Standardization are actively involved in cloud computing and cloud service standardization. Their work has borne fruit in areas such as cloud interfaces, cloud services, and cloud security. However, the pace of cloud computing standardization research may be impeded by factors such as competition among cloud computing service providers, limited application scope, and technical hurdles.

China's cloud computing research began relatively recently but has achieved significant progress in recent times. Key organizations involved in cloud computing standardization in China include the Cloud Computing Expert Committee of the China Electronics Society, the China Communications Standards Association, and the National Information Technology Standardization Technical Committee. These entities refer to the cloud computing standardization framework, analyze existing communications and information technology standards, formulate new national standard research and development directions, and integrate multiple regional achievements [4].

4.2. Problems existing in cloud computing standardization research

An assessment of current research domestically and internationally reveals several primary issues in cloud computing standardization research. First, there is a lack of organizations and enterprises actively participating in the formulation of cloud computing standards, and a dedicated institution with the requisite scale and research capabilities has yet to be established. Second, during cloud computing standardization research, the problem of fragmentation persists. While most computing resources are integrated into the cloud, forming a resource pool with vast data, many suppliers do not open interfaces for data transmission and connection. Various industries and institutions are hesitant to promote open-standards research [5]. Third, research directions in cloud computing subdivisions need harmonization. Although some progress has been made in areas such as definition, architecture, security, timeliness, structure, and interoperability, more fundamental standardization is required to establish a comprehensive standard system for cloud computing.

5. Strategies for cloud computing standardization to empower the development of digital economy industries

5.1. Breaking down technical barriers

To ensure the effective role of cloud computing standardization in advancing the digital economy industry, it is essential to dismantle technical barriers, foster resource sharing, and expedite research and development processes. Some cloud computing service providers currently possess significant independent research and development capabilities. Market leaders in cloud computing solutions, such as Citrix and Vmware, can execute tailored research and development for cloud computing businesses while endorsing open-source solutions for enterprises. They can construct relatively mature cloud computing services, product standards, and technical solutions. Nevertheless, the focus of cloud computing standards' research and development should extend beyond the system and concentrate on external interfaces. Thus, during specific research and development phases, the real-world situation should be considered, with a focus on enabling dedicated or private cloud interface platforms to provide valuable reference data for cloud computing standardization research [6].

5.2. Strengthening business standardization research

At this stage of cloud computing standardization research, most organizations prioritize security, interoperability, and migration services. In addition to ensuring compatibility between similar services offered by different operators, cloud computing service providers must interconnect to establish a more rational and comprehensive market competition framework. Within the realm of interoperability, standardization requirements emerge in the relationships between storage clouds and computers, as well as between infrastructure clouds and software clouds [7]. In the field of migration business, the aim is to prevent issues such as user lock-in and business monopolies through cloud computing standardization research, preserving a healthy market environment. This involves addressing standardization needs in areas such as resources, data description, and business definitions through cloud computing standardization research to empower the digital economy industry. In the realm of security, cloud security research entails privacy protection and necessitates the establishment of a robust regulatory and legal framework to ensure the anticipated outcomes of security protection and data encryption on cloud platforms while averting potential security risks associated with interfaces.

5.3. Actively promote IaaS standard research

A comprehensive analysis of the digital economy industry reveals that the IaaS-related industry chain is relatively mature. It provides a convenient and effective route for traditional enterprises to transition their

data centers to cloud computing. From a technical perspective, IaaS-related concepts and technologies are relatively mature and comprehensive. Goals and forms are reasonably consistent in fields such as distributed storage and host virtualization. Consequently, there is a substantial market demand for IaaS standardization, and it is technically feasible. Relevant institutions can prioritize IaaS as a pivotal focus of cloud computing standardization research and apply the findings to stably and healthily advance the digital economy industry [8].

5.4. Raising awareness of cloud computing standardization

The application scope of cloud computing-related fields continues to expand. To encourage its standardized, sustainable, and open development, there is a need to heighten awareness of standardization and substantially reinforce research in migration services, interoperability, and other areas. It is crucial, in the course of cloud computing standardization research, to stimulate creativity and enthusiasm among research institutions, enterprises, and suppliers while providing ample space for industry-related enterprises to ignite endogenous growth and standardize cloud computing. This will empower the development of the digital economy industry. Currently, organizations worldwide attach significant importance to cloud computing standardization. Microsoft and Intel are both members of the Distributed Management Task Force (DMTF) board of directors, and Google actively engages in the Internet Engineering Task Force (IETF) discussions related to cloud computing standardization. Numerous companies in China are actively participating in cloud computing standardization research. Huawei is a member of DMFT, Lenovo holds a leadership role in the DMFT, and Zhongxing Telecom Equipment (ZTE) organized a cloud computing Birds of a Feather (BOF) under IEFT. China Telecom partook in the Open Cirrus global cloud computing R&D test platform. Through the collective efforts of these institutions, cloud computing standardization has reached a consensus. In the future standardization research processes, it is imperative to delve into the needs of the digital economy industry, conduct personalized cloud computing standardization research, and actively advance the stable and healthy development of the digital economy industry [9].

6. Analysis of cloud computing standardization empowering the development of the digital economy industry

To propel the development of the digital economy industry, pertinent departments in China have devised the "Guidelines for the Construction of a Comprehensive Standardization System for Cloud Computing." This document outlines the ideas, principles, and guiding ideology for building cloud computing standards. It is based on the products, technologies, services, and products within China's cloud computing system, with the aim of forming a cloud computing standardization framework for the digital economy industry.

The cloud computing standardization framework aligns with the actual needs of the digital economy industry's growth. Its primary components encompass cloud security, cloud services, cloud resources, and cloud foundation.

Firstly, in cloud security, the central function of the standards is to ensure information security, service security, network security, and system security in cloud computing environments. These standards cover security technologies, service security, security management, and security foundations.

Secondly, cloud services standards serve to standardize and enhance various aspects of cloud service design, delivery, operation, and procurement. These standards determine the requirements in fields such as service procurement, service quality, service measurement, billing methods, and service capability evaluation.

Thirdly, cloud resources standards guide and standardize the development of cloud computing software and hardware products. They establish standards for the use and management of cloud computing resources,

improve the rapid elasticity and scalability of cloud computing, and clarify the standards for critical cloud computing technologies, resource maintenance, and resource management.

Lastly, cloud foundation standards have a unifying role in establishing common cloud computing concepts and providing effective support for determining other standards. Their primary content includes cloud computing guidelines, terminologies, and architecture standards.

The cloud computing standardization framework is developed with the needs of the digital economy industry in mind. It draws inspiration from both domestic and foreign experience, outlining the research and development direction for cloud computing standardization. This consolidated effort is expected to foster sustainable and healthy development for cloud computing and related fields in China, providing favorable conditions for growth and promoting the stable and healthy development of the digital economy industry.

7. Conclusion

Cloud computing stands as a fundamental manifestation of innovative achievements in new information technologies and a potent driving force behind the growth of the digital economy industry. To sustain and nurture the development of cloud computing, pertinent institutions must vigorously intensify research and promotion efforts in cloud computing standardization. This includes dismantling technical barriers, reinforcing security, standardizing interoperability, and advancing migration business standards. It also requires the active promotion of IaaS standard research and an effective enhancement of awareness regarding cloud computing standardization. By doing so, cloud computing standardization can fulfill its intended role and contribute to the advancement of the digital economy industry.

Disclosure statement

The author declares no conflict of interest.

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