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Postprint: Research on Broadcasting Converged Media Service Cloud Platform Based on Hyper-converged Architecture

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Abstract

In recent years, journalism and communication universities have been constructing media convergence platforms. To cultivate innovative professionals in journalism and media, Sichuan University of Media and Communications has integrated its resources to transform its news center into a broadcasting and media convergence service cloud platform based on hyper-converged architecture and HD acquisition and editing. The university has conducted detailed planning in terms of system construction concepts, overall planning, framework structure, and other dimensions, and has analyzed the business platform design and technical highlights from three perspectives: resource layer, business layer, and management layer.

Full Text

Preamble

Research on Radio and Television Converged Media Service Cloud Platform Based on Hyper-Converged Architecture

Abstract: In recent years, universities related to journalism and media have been actively constructing converged media platforms. To cultivate innovative professionals in journalism and media, Sichuan University of Media and Communications has integrated its resources to transform its news center into a radio and television converged media service cloud platform built on hyper-converged architecture and HD acquisition and editing capabilities. Detailed planning has been conducted regarding system construction concepts, overall planning, and framework structure, with business platform design and technical highlights analyzed from three perspectives: the resource layer, business layer, and management layer.

Keywords: hyper-converged architecture; converged media; service cloud platform

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1.1 Hyper-Converged Architecture

The overall planning and design of cloud platform construction must be based on a detailed analysis of the characteristics and logical relationships among various businesses within the target broadcasting system, while maintaining foresight for future business development. Hyper-Converged Infrastructure (HCI) is a software-defined, horizontally scalable architecture that integrates core data services into industry-standard servers, thereby providing flexible and powerful building blocks under unified management. Under the HCI architecture, all key functions of the data center can operate within the software layer, simplifying service delivery that previously required dedicated hardware. The three core components of HCI are computing virtualization, storage virtualization, and management software. Virtualization software abstracts and pools underlying resources, dynamically allocating them to applications running in virtual machines or containers. Users benefit from a new operational model where computing, storage, and network connectivity can be managed from a single tool, with advanced management functions further reducing manual tasks and helping automate all operational and maintenance work.

1.2 Converged Media

Converged media based on radio and television services represents a new media model featuring comprehensive media functions, integrated core elements of communication methods and organizational structures, and diversified information dissemination channels. Therefore, converged media based on broadcasting business refers to cross-border media that expands through multiple internet-based broadcasting channels and operates multiple services, utilizing a converged resource platform to form an all-media integrated production platform, business integration, content integration, and media resource integration.

1.3 Hyper-Converged Architecture Converged Media Cloud Platform

The hyper-converged architecture media cloud platform is built on cloud computing, employing open-source architecture and open software interfaces to fully integrate network, security, computing, storage, and other infrastructures, thereby providing customized and elastic cloud service resources. The cloud platform

possesses multi-channel resource aggregation and big data analysis capabilities, with functions including content aggregation, converged production, and content distribution. It enables system construction and expansion toward converged media business, promotes deep integration of traditional and new media across content, channels, platforms, operations, and management, and achieves transformation in media service integration and application.

2. Overall Approach to Hyper-Converged Media Platform Construction

Promoting the construction of a converged media platform requires clear strategic objectives. The development direction for platform evolution is “technology platformization, business productization, and service ecologization.”

2.1 Technology Cloudification

According to market development needs, cloud computing is undoubtedly the inevitable choice. First, the entire platform must be constructed under an overall cloud architecture to build a cloud service platform. At present, most cloud platforms carry comprehensive media news services, while other services such as content production, television program production, and new media content production will gradually migrate to the service cloud platform. The entire platform is divided into IaaS, PaaS, and SaaS layers, each bearing different services: (1) IaaS: The Media Infrastructure Service layer provides a unified foundational platform environment for resources such as computing, storage, and network; (2) PaaS: The Media Platform Service layer provides unified support software for media public tool services; (3) SaaS: The Media Software Service layer provides integrated applications such as tool software and portal integration software for new media services.

2.2 Business Productization

Production on the service cloud platform serially connects business processes: program materials are uploaded to IaaS storage, then graphics and subtitles are produced using cloud service tools, audio and video synthesis is completed, and the final product is generated as audiovisual content suitable for distribution, which is submitted to the platform for publication review.

2.3 Service Ecologization

Starting from innovation in the service system, the cloud platform achieves collaborative development of services such as converged media content aggregation, production, and data analysis through the service ecological platform provided by the PaaS layer.

3. Business Requirements and Objectives

The converged media platform aims to achieve “aggregation and sharing of information resources from various channels, unified planning, service orientation, and multiple input and output.” As a platform serving both group new media departments and radio and television production departments, it must possess the following production capabilities: (1) Basic support capability: First, integrate IT infrastructure resources through private cloud and virtualization technologies to uniformly provide basic services for upper-layer businesses, maximizing resource utilization and significantly reducing initial system investment and ongoing operational costs; second, establish a converged media support platform to provide content, services, and management support capabilities for converged media business modules. (2) Content aggregation capability: Integrate existing program production systems, media asset systems, and internet-related content resources to provide content support for converged media production. (3) Command and dispatch capability: Ensure efficient production management capabilities for daily news and breaking news through unified topic selection, planning, and command dispatch. (4) Content management and production capability: First, aggregate all resources into a content repository, providing unified management, classification, and retrieval functions; second, enable rapid content editing and traditional program production. (5) Content distribution capability: Achieve distribution of converged media content to both the internet and traditional broadcasting networks through the content publishing center. (6) Operations monitoring capability: Realize platform monitoring and resource management. (7) New media support capability: Establish a support system for new media resources oriented toward WeChat matrices, Weibo matrices, news apps, and television station matrix accounts, providing unified content support capabilities to new media.

4. Business Platform Design

The converged media platform planning and design should focus on content aggregation as the core, collecting information from multiple perspectives and dimensions; use the all-IP production command and dispatch center as the central nervous system, the production center as the tool, and the publishing center as the channel; fully utilize distribution technologies from both traditional and new media to further open development channels for radio, television, and new media, enhance news timeliness and interactivity, and improve user stickiness.

4.1.1 Automated Cloud Data Center Design Based on IaaS Cloud Platform

Through the construction of data centers using computing virtualization systems, a cloud management platform is employed for resource management and provides self-service cloud services, enabling standardization of enterprise information system technologies and normalization of management, thereby providing better support for enterprise information system development. The cloud

management platform requires virtualization support to achieve on-demand, automated, and metered allocation of basic resources, managing network, computing, and storage while monitoring and managing resource usage and health status.

4.1.2 Software-Defined Information Security and Dynamic Scheduling of Basic Resources

The introduction of virtualization and cloud computing forms resource pools for computing, storage, network, and security. After resource pooling, network boundaries become ambiguous, requiring new technologies to address isolation capabilities in virtualized environments and achieve dynamic scheduling of basic resources among different tenants. Based on software-defined technology, allocating computing, storage, network, and security resources to different tenants forms virtual cloud platforms, between which effective and secure isolation can be achieved to meet security requirements. Through the cloud management platform, basic resources can be flexibly scheduled among different virtual data centers, truly realizing dynamic, on-demand allocation, scheduling, and provision of resources in cloud computing data centers. Based on software-defined technology, desktop cloud resources are delivered to front-end thin clients, PCs, mobile phones, PADs, and laptops by pooling computing and storage resources. Desktops, applications, and data on PCs are migrated to the virtual desktop area in the data center, with only images and instructions transmitted to the front end while data never lands, ensuring a secure and efficient desktop environment in free workstation areas and technical support zones.

4.1.4 Security Situation Awareness Based on Network-Wide Traffic Collection and Analysis

This approach achieves security detection of network-wide traffic and conducts behavioral analysis for visualized early warning detection, enabling real-time monitoring of potential threats to business and internal networks.

4.1.4.1 Network Framework In the hyper-converged architecture built using network virtualization, the most important technology is the VxLAN “large layer-2” design adopted in the data center area below the core switch. Virtualized distributed switch technology reduces dependency on physical device configuration for network topology configuration, making configuration more flexible.

4.1.4.2 Computing Framework The core of the cloud computing platform is the “computing” function of servers. Virtualization technology is used to pool physical resources such as server CPU, memory, and I/O, implementing unified management, scheduling, and logical resource allocation. Multiple operating environments are constructed simultaneously in logical resources, thereby

achieving agile scheduling of computing resources, lower operating costs, higher flexibility, and faster business response times.

4.1.4.3 Storage Framework The converged media cloud data center is developing from independent construction of single traditional media systems toward integrated production of “acquisition, editing, broadcasting, storage, and management,” with continuous business type integration, placing higher requirements on storage system reliability, scalability, and performance. Traditional storage can no longer meet these needs. For converged media requirements, a new generation of software-defined unified storage has been introduced. Software-defined storage achieves storage cloudification, providing block, file, and object storage services that can carry multiple business accesses and adapt to cloud computing services in combination with applications.

4.1.4.4 Security Framework Network and system security mainly includes the following aspects: Security protection: The converged media platform has its particularities, so security protection is paramount. The security construction of the converged media platform should strictly follow the national information technology system security level-3 protection standards. High availability: Possess high-availability cluster (HA) functions while providing fault-tolerance mechanisms to ensure data integrity or normal system operation. Data backup: Create a professional data backup system that implements database backup based on the converged media platform virtualization architecture, while providing rapid data backup and recovery for entire virtual hosts or disks.

4.2 Content Aggregation and Management Platform Design

The functions of the content aggregation platform and content management platform include flexible and efficient upload management of materials, with aggregated content comprising various multimedia files such as video, audio, images, and text. The content management platform is a video and audio management system based on SaaS cloud computing architecture that meets operational needs, specifically adapted for rapid editing and production of programs oriented toward the internet and new media.

4.3 Command and Dispatch Center Design

The command and dispatch center displays various data such as program production processes, geographic locations, publishing dispatch, content topic selection, productivity statistics, video connections, influence analysis, and public opinion monitoring on the large screen of the dispatch center, providing program fusion production command dispatch and decision support for business departments. Simultaneously, it systematically presents nodes and steps in the radio and television fusion production process.

4.4 Content Production and Distribution Platform Design

The content production platform classifies media asset resources through intelligent analysis and computing, provides retrieval services, and achieves mobilization of production processes such as content editing and processing, rapid distribution, and collaborative work. The production and distribution platform includes tools such as 4K-based multimedia editing, WeChat application editing, Weibo program editing, video editing, rapid editing, and refined editing, enabling rapid program production. Ultimately, besides distribution through traditional radio and television channels, it can achieve multi-screen and multi-terminal distribution through mobile internet.

4.5 Big Data Analysis Platform Design

By achieving comprehensive monitoring and retrieval of channel content and producing various business reports, the platform employs a local lightweight deployment method relying on third-party big data analysis and processing platforms to achieve full business data analysis and operation services including network-wide public opinion monitoring, content dissemination analysis, terminal data insight analysis, and terminal intelligent recommendation.

5.1 Cloud Platform Based on Hyper-Converged Architecture

Enterprise-level cloud architecture based on hyper-converged architecture and software-defined storage can achieve flexible software-defined computing, rapid deployment, migration, scaling, and protection of applications and data. Hyper-converged architecture ensures the integration of software-led networking and security, storage, and dynamic resource scheduling mechanisms for virtual data centers, obtaining comprehensive agility of cloud computing infrastructure.

5.2 Good Network Security Situation Awareness

Based on advanced concepts such as converged security architecture and software-defined security, a closed-loop security system of “prediction, protection, detection, and response” is formed. Leading technologies such as cloud computing based on hyper-converged architecture, network-wide security visibility, dynamic perception, and closed-loop linkage are adopted to achieve pre-event risk prediction, proactive security protection during events, continuous post-event detection, and collaborative response, with security visualization.

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