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Design of a Cross-Platform Intelligent Platform for Media Asset and Converged Media Content Management (Postprint)

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Abstract

[Objective] To design and construct a next-generation intelligent media asset management application platform for converged media content.

[Methods] Based on a unified cloud infrastructure backend, with content middle platform, intelligent middle platform, and data middle platform as the capability guarantees, and supported by advanced technologies such as cloud computing, microservices, middle platform processing, and big data, we built a unified portal with omnimedia support, multiple AI intelligent function applications, and file interconnection across various network platforms.

[Results] Through the optimized design of the platform's overall requirements, framework design, system network, network security, business processes, and business functions, the final construction design scheme was completed.

[Conclusion] The intelligent media asset business application platform designed in this study possesses sustainable scalability and can continuously empower and ensure intelligent production management and application of omnimedia asset content in the converged media era. It will also strongly promote the intelligent development of media convergence at Nanjing Radio and Television Group.

Full Text

Preamble

Design of a Cross-Platform Intelligent Media Asset Management and Converged Media Content Application Platform

(Nanjing Broadcasting Group, Nanjing, Jiangsu 210000)

Abstract

[Objective] To design and construct a new-generation intelligent media asset management and converged media content application platform. **[Methods]** Based on a unified cloud infrastructure backend, with content middle platform, intelligent middle platform, and data middle platform as capability guarantees, and supported by advanced technologies such as cloud computing, microservices, middle platform processing, and big data, the platform establishes a unified portal with omnimedia support, multiple AI intelligent function applications, and interconnectivity across various network platforms. **[Results]** Through optimized design of platform overall requirements, framework design, system network, network security, business processes, and business functions, the final construction design scheme was completed. **[Conclusion]** The intelligent media asset business application platform designed in this study possesses sustainable scalability, can continuously empower and support intelligent production management and application of omnimedia media asset content in the converged media era, and will effectively promote the intelligent development of media convergence at Nanjing Broadcasting Group.

Keywords: Intelligent Media Asset; Cross-Platform Converged Media Content Library; PaaS Platform; Unified Portal

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1. Platform Introduction

This project designs and establishes a cross-platform intelligent media asset management and converged media content application platform based on a “local + cloud” architecture. The platform fully adapts to current media convergence development requirements by integrating news media assets, historical media assets, and converged media content libraries, while aggregating various media resources of Nanjing Broadcasting Group to form a branded media asset library for the group. It provides media asset storage and production support across all platforms for media production, interaction, and distribution. Through media production management statistics and multiple AI technology supports, the platform achieves refined management and application of media assets, constructs a media production application data platform to provide data support for media production and operational expansion, and simultaneously protects user creation rights through comprehensive user management and integration with corresponding blockchain platforms for content rights confirmation and transaction services. This creates an industry-leading media asset management application platform that comprehensively supports the development of Nan-

ing Broadcasting Group's media convergence production and expands market value. The new platform achieves comprehensive qualitative improvements in ultra-high-definition video support, new media format compatibility, intelligent production management, efficient storage and application of media asset content, interconnection of content across the entire station network, and unified user management across the entire station.

[FIGURE:1] Platform Positioning

2. Overall Requirements

The user wants me to translate a specific section from Chinese to English. The section is “### 2.2 General Requirements” from an academic paper.

Let me analyze the text:

”### 2.2 General Requirements

The media asset management platform is a foundational service support platform that provides basic content support for omnimedia content production and media operations across all departments and programs of Nanjing Broadcasting Group. It supports media content including news, lifestyle, entertainment, special topics, large-scale events, various production content from current business departments, and historical 精华 content. The platform provides media asset means support by offering efficient storage, management, retrieval, and transfer of various existing and incremental media files for business departments and users, achieving multi-platform interoperability and cross-platform supply. The data support includes uploaded data, usage data, file data, and user data.”

Key points: - It's about a media asset management platform for Nanjing Broadcasting Group - It provides foundational service support - Supports omnimedia content production and media operations - Covers all departments and programs - Supports various types of media content including news, lifestyle, entertainment, etc. - Mentions “historical 精华 content” - I need to translate “精华” which means “essence” or “premium” or “high-quality” - Provides storage, management, retrieval, and transfer - For existing and incremental media files - Achieves multi-platform interoperability and cross-platform supply - Data support includes uploaded data, usage data, file data, and user data

I need to follow the translation guidelines: - Produce flowing, readable prose - Merge fragmented text into complete sentences - Skip garbage text (none here) - Organize by logical sections - Each paragraph should express a complete thought - Use clear topic sentences and logical transitions

The structure is already a single paragraph, which is fine. I need to make sure it's fluent and academic.

Let me translate it:

“The media asset management platform is a foundational service support platform that provides basic content support for omnimedia content production and media operations across all departments and programs of Nanjing Broadcasting Group.”

This sentence is good. I'll keep it mostly as is, but maybe slightly refine for flow.

“It supports media content including news, lifestyle, entertainment, special topics, large-scale events, various production content from current business departments, and historical 精华 content.”

Here “精华” needs translation. In the context of media content, “historical 精华 content” likely means “historical premium content” or “historical essence content” or “historical highlights”. “Premium historical content” or “historical archival highlights” might work. Let me think about the best academic term. “Historical essence content” is too literal. “Historical premium content” is better. Or maybe “historical archival content” but “精华” suggests the best/selected content. I'll go with “historical premium content” or “historical highlights”. Actually, in broadcasting context, this often refers to “historical archival content” or “legacy content”. But “精华” specifically means “essence” or “cream of the crop”. “Historical premium content” seems most appropriate.

“The platform provides media asset means support by offering efficient storage, management, retrieval, and transfer of various existing and incremental media files for business departments and users, achieving multi-platform interoperability and cross-platform supply.”

This is a bit clunky. “media asset means support” is awkward. The original says “媒资手段支持” which means “media asset tools/support means”. I could rephrase to “The platform provides media asset management support” or “The platform supports media asset operations by offering...”. Let me think. “provides media asset means support” - maybe “provides media asset management capabilities” or “provides support for media asset operations”. The phrase “means### 2.2.1 Unified Media Asset Management Interface Portal

The platform integrates existing video media asset data to establish a unified portal for media resource control and storage, completing technical transformation for unified media asset management and unified cataloging. This enables unified management of media asset data at the application system level and lays the foundation for full online operation and management of the video media asset library.

2.2.2 Comprehensive User Management

The platform implements comprehensive user management, points management (contribution values), and data management for historical programs and various current production video and audio program materials and multiple media format resources across the station. This protects the media creation rights

of each channel, program, and individual within the station while facilitating access and management for various users.

2.2.3 Service for Full-Platform Content Production and Distribution

The platform provides media asset resource support and management for full-platform converged production, better serving media content production and distribution across all platforms within the station (traditional channel terminals and new media terminals). It comprehensively supports business browsing, querying, production, and review on user-end computers and mobile devices.

2.2.4 Full-Station Network Access and Production Support

The platform enables access, production, retrieval, cataloging, and storage across various production networks within the station, including news network, education and science network, children's channel network, Channel 18 network, special topic network, film and television network, lifestyle network, and advertising network. It also supports access from office networks and external networks, implementing modular download and upload capabilities based on user permissions with process-oriented management of cataloging and user rights.

2.2.5 Interconnected Access and Synchronization of News Production Media Asset Data

The platform achieves data interconnection for news production media assets, enabling synchronized access and retrieval across application platforms and network terminals.

2.2.6 Formation of Branded Media Asset Product Library Supply Chain

The platform establishes interfaces for business expansion, enabling multi-platform file-based supply to facilitate third-party market expansion for group media operations. It forms a comprehensive and effective media asset library product supply chain for the broadcasting sector using universal interface solutions.

2.2.7 Integration with Blockchain Copyright Platform

The platform integrates with blockchain platforms to provide media asset rights confirmation and transaction channels, enabling market monetization of group media asset content value. It can query media files of various institutional users on the blockchain platform and establish a parallel and replicable platform architecture. This empowers the media asset management platform while also serving as a regional demonstration for Nanjing Television's blockchain platform construction.

2.2.8 Intelligent Data Management of Media Assets

The platform implements a cross-platform unified cloud storage system where all user data achieves “full online” status in an application sense. It comprehensively introduces AI intelligent technology to lay the foundation for big data mining and intelligent analysis based on multimedia content. The platform conducts full data management and intelligent processing of internal users and various media asset products to maximize media asset value, expand application channels, protect all rights, and create a good sustainable media asset application environment.

2.2.9 Full-Chain Data Analysis of Media Assets

The platform conducts data analysis and statistics on in-station production and usage of media assets, including production data, retrieval data, and user data. This involves user management, program management, points management, and citation value (rankings, viewing, download statistics, etc.) to promote and enhance media content production and distribution across the station.

2.3 Platform Overall Framework Diagram

[FIGURE:2] Overall Framework Diagram of Media Asset Management Platform

2.4 Platform Technical Architecture Design



Figure 1: Figure 3

Simplified Diagram of Platform Technical Service Architecture

The intelligent media asset platform is designed according to a three-layer architecture comprising basic resources, media service platform (including middle platform services), and business applications. Supported by advanced technologies such as cloud computing, microservices, middle platform processing, and big data, the platform constructs a sustainable and scalable new-generation media content asset management system. Based on user management and IP network routing connections, it can connect file-based to various production networks, studios, and production terminals within the station, supporting access, application, and review from office networks, external networks, and mobile devices. It serves frontline production departments such as the news center, product center, various channel frequencies, Niuka Video, and MCN, achieving full-station sharing and operationalization of content resources.

The system construction specifically includes the following components:

2.4.1 Intelligent Media Asset System Basic Resource Platform Based on a cloud foundation, the platform optimizes and uniformly manages resources, supporting elastic allocation. After construction, the platform possesses high scalability, with both computing and storage resources expandable through node addition. This project adopts private cloud construction to serve in-station end businesses.

2.4.2 Media Service Platform Fully implementing the PaaS platform design concept, the media service platform comprises service framework management, middleware services, and process engine services. It adopts a decentralized, distributed, and elastic architecture with a microservices management framework to provide unified support for various business services and applications, achieving unified resource management.

2.4.3 Middle Platform Capability Construction

2.4.3.1 Content Management Middle Platform

Relying on an intelligent tag system, the platform integrates internal and external system resources to establish a new-generation omnimedia content library oriented toward new media and television media production and distribution scenarios. It covers various media formats including video, audio, and graphics while providing related processing capabilities such as frame extraction, file analysis, migration, transcoding, and technical review analysis. Combined with the group's blockchain platform, it achieves precise content copyright management and transactions. The video content middle platform system constructed in this project provides unified interfaces for content docking with production domains and internet new media content production domains.

2.4.3.2 AI Middle Platform

The platform comprehensively adopts multiple intelligent services to meet intelligent processing business requirements. In this project, it will gradually

implement capabilities such as speech recognition, OCR text recognition, face recognition, scene recognition, natural language processing, pornography and violence detection, intelligent super-resolution, and intelligent restoration. It also combines fusion inference technology to achieve automated tag extraction, providing various intelligent result outputs for upper-layer businesses. Considering comprehensive usage and cost investment, an intelligent system resource pool is established for full-station invocation to comprehensively support media asset management, production, and operations. This intelligent resource pool can be integrated into media asset platforms and production platforms, adopting a hybrid deployment model of partial localization plus partial cloud resource support with elastic scaling and pay-per-use services.

2.4.3.3 Data Middle Platform

The data middle platform provides comprehensive data analysis and statistics functions, processing massive data within the media asset platform such as user data, storage data, and application data according to business requirements for statistical output and display.

The functional modules include upload, cataloging, review, cloud storage, retrieval, statistics, rights management, and external interface configuration. The platform satisfies application scenarios such as traditional media asset management, intelligent applications, file interaction across various networks, data statistics, and mobile applications. Intelligent applications include intelligent cataloging, intelligent recommendation, and intelligent review, which enhance material management and application based on intelligent foundations.

3.1 Network Structure

The entire network adopts a 10 Gigabit backbone with Gigabit access. Most servers and workstations within the network use Gigabit access, while media processing servers use 10 Gigabit access. Connections between the media asset system and other business systems use 10 Gigabit/Gigabit links based on usage requirements. The 10 Gigabit link connection mode includes news network, converged media production system, broadcast system, and new media system (including Web, mobile, and media matrix). Connection with the broadcast system and new media system is achieved through existing security devices in those systems. The Gigabit link connection mode applies to internet-facing businesses, including office networks and subsequent operation systems in internet environments. A high-security zone is constructed using proxy servers and security gateway protection for effective control.

3.2 Media Formats

The platform achieves integration of various media format resources, including video, audio, images, and documents such as 4K, 8K, multi-format, multi-resolution video, VR video, multi-format audio, pictures, documents, H5, and design engineering files. It supports nesting and association between resources,

enabling unified management of complex business objects to adapt to the current converged media and new media production environment.

3.3 Local Storage Design

3.3.1 Storage Design and Technical Requirements The platform adopts distributed storage with multi-node 4:1 erasure coding design, providing 80% effective capacity. The distributed cluster storage (36-bay) employs cloud storage technology with fully symmetric architecture for horizontal scalability. It supports metadata cluster deployment and intelligent SSD read-write caching technology, as well as multi-dimensional data protection methods such as multi-copy and N+M erasure coding. In fusion interface mode, it supports NFS, CIFS, FTP, iSCSI, S3 protocols, and intelligent load balancing.

3.3.2 Nearline Storage Capacity As the backup storage medium for the entire media asset system, Blu-ray nearline storage is used. Since Blu-ray storage is non-erasable, the process is controlled to ensure reasonable utilization of backup space. Valuable materials are archived into the library, with capacity allocated to corresponding departments to control storage volume.

3.5 Connection with Blockchain Platform

Connection Requirements: During content file cataloging, users can select copyright deposit and public file display, with copyright deposit and default display as default options. According to cataloging security levels, top-secret and confidential files are not publicly visible by default. Corresponding users logging into the blockchain platform can also view rights-confirmed files and certificates, enabling batch rights confirmation and deposit operations. Existing stock media asset data imported in batches can be deposited in bulk, with public security-level files displayable on the blockchain platform. Content within the security zone can be fully displayed.

Copyright Confirmation: Only archived files can undergo copyright confirmation operations. Archived files have already been reviewed by corresponding department auditors for cataloging approval. After certificates and data are returned, they serve as metadata for the content file.

File Transfer: Features include user and institutional user information (uploading user, affiliated channel/department), low-resolution files, and source file characteristic encryption codes (hash values) generated upon media asset entry according to corresponding algorithms. The stock media asset library performs batch deposit operations during import to the new media asset system, using characteristic codes and file names for rights confirmation and deposit.

3.6 Data Center System

The data center monitoring system displays main platform data of the media asset system on large screens. Content monitoring includes: incoming media

assets, individuals, programs, channels, storage, retrieval, and publishing, with model chart summaries. System monitoring includes: task monitoring, data monitoring, storage monitoring, service monitoring, and alarm logs. User monitoring includes: departments, employee contribution levels, usage levels, production status, and file correspondences.

3.7 Intelligent Functions

Since the intelligent system can be applied to full-station production and management, an intelligent system resource pool is established to maximize benefits. This intelligent system serves as the full-station intelligent middle platform, oriented not only toward the media asset platform but also toward other business production systems to comprehensively support media asset management, production, and operations. It reserves unified management capabilities for more local + cloud intelligent services, detailed in the “Intelligent Processing Middle Platform Solution.” The platform tools of this intelligent resource pool can be integrated into media asset platforms, production platforms, and new media platforms, adopting a hybrid deployment model of partial localization + partial cloud resource support with elastic scaling and pay-per-use services to maximize input-output ratios and ensure more accurate and comprehensive functional applications. In this solution, the media asset management platform serves as an important user of the intelligent middle platform system, with various intelligent services relying on the intelligent middle platform for support, including intelligent cataloging, intelligent analysis, intelligent tagging, intelligent review, multimodal search, intelligent super-resolution, and knowledge graph functions. Future intelligent capabilities can be expanded to fully empower production systems, providing backend capability support for content management and production resource platforms such as intelligent editing, intelligent clipping, intelligent subtitling, intelligent dubbing, intelligent creation, intelligent translation, and intelligent AR.

4. Business Functions

4.1 Business Process Design

4.1.1 Upload Process (Figure 5) Upload and Acquisition: External files are imported through upload workstations, supporting multiple types of media.

Business System Archiving: Various business systems can archive finished productions and materials through networked processes, with terminals in each business network able to perform corresponding review operations. During review, prompts are provided for sensitive information and technical specifications of content.

Intelligent Tagging: Through AI processing technology, information from video and audio files is automatically extracted. After fusion inference processing, exclusive media asset management tags are formed. For news programs,

multi-level cataloging tags are implemented (program level, segment level, scene level, shot level). For other program types, program-level tags for voice, subtitles, and portraits can be filled.

Cataloging Task Allocation: Cataloging is primarily conducted by individuals and their departments, with each department determining allocation based on its production situation. Assisted by intelligent cataloging technology systems, permissions can be extended for cross-department allocation to professional cataloging team personnel roles, subject to actual conditions and leadership approval.

Entry into Library: After review and approval by department media asset administrators or corresponding responsible persons, content is entered into the media asset system, saved to object storage, while the transcoding module generates low-bit-rate files for browsing across various platform terminals.

Cataloging Review and Correction: Manual cataloging review and correction functions are provided to adjust intelligently annotated content.

4.1.2 Download Process (Figure 6) The platform adopts a multi-terminal design with unified users and a unified portal for multi-platform access. The front-end design includes user desktop and mobile interfaces. The portal functional modules mainly include media content management, user management, upload/download management, retrieval and query, review management, message management, rights management, copyright management, process management, and storage space management (Figure 7).

Retrieval: Users retrieve through the unified portal to view files within their permission scope, browsing low-bit-rate streams, keyframes, and cataloging information in the converged media content library.

Pre-editing: Users can quickly mark low-bit-rate points within the media asset system. The backend completes high-bit-rate generation for low-bit-rate marked content before high-bit-rate download of media assets.

User Retrieval: Can be divided into cross-department application download and intra-department application download.

4.1.3 Process Configuration Process Engine: As business processes in the intelligent media asset system become increasingly diverse, with variations among different business processes, a complete process engine is required as business flow support to meet diverse business needs and task processing monitoring requirements.

4.2 Business Function Modules

The platform includes functional modules such as media content management, user management, rights management, and external interface configuration. It satisfies application scenarios including traditional media asset management,

intelligent applications, file interaction across various networks, data statistics, and mobile applications. Intelligent applications include intelligent cataloging, intelligent recommendation, and intelligent review, which enhance material management and application based on intelligent foundations.

Media Content Management: Includes but is not limited to video libraries, audio libraries, image libraries, and document libraries. Media file management supports multi-layer, multi-category management with logical classifications such as material area, finished area, and security area, as well as multi-level security management (secret, normal, public). Security area content can be fully visible to the public for external release and market expansion.

Program Management, Character Management, and Recommendation Rankings: The platform includes dedicated video display pages supporting classification retrieval by category, duration, resolution, and other information. Dedicated image display pages support classification retrieval by size, color, category, and other information. Dedicated audio display pages support classification retrieval by category such as pop and classical. The system records program and image view counts, download counts, and downloading users, generating charts.

Anti-Virus Management: The system is protected by firewalls, security gateways, and other devices to prevent viruses.

Through platform construction, human resource costs in content production, cataloging, query, and review can be effectively reduced, while both stock and incremental media asset resources can be effectively managed, cataloged, and reviewed to provide effective supply for production and distribution businesses. The platform also enables effective statistics on media asset production application data to provide effective data support for full-station production and evaluation. The platform application also meets current converged media market needs, enabling effective supply and docking with third-party platforms. Combined with the blockchain copyright platform, it can effectively protect Nanjing Television's media asset properties and provide value realization channels for relevant production departments and copyright-owning departments. The platform construction aligns with media industry development trends, holds significant importance for occupying media propaganda positions, deeply exploring core media asset values, and maintaining correct public opinion guidance. It will also powerfully promote the intelligent development of media convergence at Nanjing Broadcasting Group.

5. System Security

Based on comprehensive functional design, the platform maximizes security concerning network security, account security, data security, and physical security, meeting Level 3 protection requirements. In this project design, to fully guarantee internal network security, a high-security zone is constructed to achieve security protection between the media asset system and office/external networks.

Proxy servers are deployed within the high-security zone with strict access control. Effective and clear division of various business areas is implemented, with security devices requiring strict access control. Network link and device redundancy, server dual-machine hot backup, high-availability technology, and load balancing technology are adopted to avoid single points of failure.

Network Structure Security: The design eliminates single points of failure, theoretically preventing local failures from causing global paralysis. Core links adopt dual-link configurations, and main switches use dual-machine stacking mode.

Data Transmission Security: Multiple switches are stacked and divided into VLANs, ensuring that failure of any single switch will not cause complete site failure.

Software System Security: Software is strictly developed according to ISO9001 and software development specifications to reduce system instability risks.

Internal Network Computer Terminal Security: All internal network computer terminals disable USB ports to prevent copying, and domain control policies restrict installation of unrelated software.

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(Responsible Editor: Zhang Xiaojing)

Figures

Source: ChinaXiv — Machine translation. Verify with original.



Figure 2: Figure 4



Figure 3: Figure 5