Postprint: A Study on Cloud-Based News Production and Broadcasting Networks

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Abstract

Cloud architecture-based news production and broadcasting networks can better streamline current news business processes, integrate independently operating sub-grids into a unified management platform, and better satisfy the development needs of TV station news operations. This paper analyzes the problems confronting current news production and broadcasting network architectures, examines the technologies and planning for news production and broadcasting networks under cloud architecture, and finally proposes issues requiring attention during the establishment of cloud architecture-based news production and broadcasting networks.

Full Text

Discussion on News Production and Broadcasting Network Based on Cloud Architecture

Abstract: Under cloud architecture, news production and broadcasting networks can better streamline current news business workflows, integrating independent sub-networks into a unified management platform to better meet the development needs of television station news operations. This paper analyzes the challenges facing current news production and broadcasting network architectures, examines the technologies and planning approaches for cloud-based news production and broadcasting networks, and finally identifies key considerations in establishing such cloud architecture networks.

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News production and broadcasting systems emerged with the advancement of digital television technology and the growing needs of news program production. In early news production, audio-visual signals were converted and stored on media such as videotapes, which served as the medium connecting various systems within a television station. However, this approach yielded low signal quality and production efficiency. Subsequent non-linear editing technologies offered higher production efficiency and enabled news content to be transformed into digital files.

With the integration of network technology into television news production, the prototype of news production and broadcasting networks was formed. Network technology enabled the workflowization of news program production, leading to the creation of numerous news production and broadcasting sub-networks within television stations. The interconnection of these news business networks facilitated the continuous maturation of news production and broadcasting systems, with the emergence of cloud architecture bringing about even greater transformation.

1.1 Current Architecture of Television News Network Systems

Television stations have now established digital and networked news production and broadcasting systems, creating production workflows for news program creation, broadcasting, and file management that enhance management levels and production efficiency. Current network designs employ a Service-Oriented Architecture (SOA) approach, coupling various systems through a dual-bus architecture that ensures each application system can operate independently. In this architectural model, the foundational network and business support layer serve as prerequisites for system interconnectivity, enabling the exchange of business and media data information.

1.2 Challenges in Current News Network Systems

Current systems face several critical challenges. First, as system scale continuously expands, management becomes increasingly complex and resources are wasted. The growth of news operations and accelerated informatization processes have led to proliferating servers and workstations. Many television stations lack proper preliminary network planning, resulting in equipment from different eras coexisting in the network without unified management of diverse hardware and software, which drives up operational maintenance costs. Numerous servers operate at less than 20% workload, with many servers and workstations remaining largely idle.

Second, systems lack sufficient elasticity to support business operations effectively. Traditional architectures feature large-scale systems that cannot be quickly adjusted. During initial network construction, accurately predicting future scale is difficult, leading to inefficient resource allocation and storage configuration. Busy business operations cannot obtain adequate resources, resulting in low network utilization, while idle resources in other businesses cannot be effectively leveraged. Additionally, compatibility issues arise with future business requirements, as existing news production and broadcasting systems may be unable to exchange information with newly configured equipment. As news business continues to evolve, original systems must accommodate new business configuration devices.

2.1 Virtualization Technology

Virtualization technology enables devices to run on virtual hardware, facilitating better hardware system expansion and simplified software configuration. CPU virtualization technology allows multiple processors to operate in parallel, supporting multiple systems on a single platform where each application runs independently without mutual interference, thereby significantly improving system efficiency. Through virtualization, various resource pools can be established, including application resource pools and computing resource pools, which dynamically allocate resources to corresponding business management systems to create an elastic IT architecture. This technology separates business operations from computing resources, with data centers providing computing services to build shared resource pools that consolidate all business operations into virtual machines. The computing resources required for news production and broadcasting can be fully virtualized, enabling scientific allocation through resource sharing and effectively improving network system management efficiency.

2.2 Cluster Computing and Cloud Architecture

Cluster computing technology utilizes networks to combine multiple low-cost computing entities into a high-performance system, constructing a computing resource pool that distributes computing capacity to terminals. This approach provides each application system with adequate computing power and information storage space, enhances overall resource pool performance, reduces terminal processing burdens, and simplifies terminals into input/output devices that share computing capabilities.

Cloud computing can provide users with dynamically allocated computing and storage platforms accessible via the internet, enabling news business services through configured terminal systems. Cloud architecture for news production and broadcasting networks, built upon cloud computing, primarily comprises Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). SaaS involves installing software on computers or servers and obtaining services from cloud providers through specific service agreements over the network, thereby acquiring sufficient computing power. PaaS provides cus-

tomers with design, development, and application hosting services, eliminating the need for separate software and hardware purchases and enabling applications and services through the platform without substantial capital investment. IaaS allows terminal devices to achieve remote access through cloud computing technology, obtaining corresponding computing power from infrastructure services without investing in basic software and hardware costs.

3.1 Planning Principles for Cloud-Based News Production and Broadcasting Networks

When planning news production and broadcasting networks, preliminary analysis of hardware and software requirements is essential to determine the specific quantities of functional servers and workstations and identify which production and broadcasting components can be virtualized. For devices requiring virtualization, processor and memory requirements should be estimated based on their attributes to determine total processor and memory usage, which then informs server quantity and type selection. Due to the characteristics of news production and broadcasting networks, certain devices cannot be virtualized: (1) specialized boards, (2) equipment with high data throughput, and (3) servers with high computing density. By establishing virtualization principles, hardware can be categorized into general servers, CPU-intensive servers, and high-application servers based on requirements. High-CPU servers can handle tasks such as transcoding, while high-application servers are suitable for compositing and non-linear editing. Different virtual resources should be configured according to server types and then aggregated and allocated based on network requirements.

3.2 Cloud Architecture Network Planning for News Production and Broadcasting

Under cloud architecture, news production and broadcasting networks should be constructed according to overall planning. Current news business workflows must be reorganized and integrated based on the actual conditions of the television station, consolidating independent networks onto a unified platform. News production and broadcasting workflows are relatively fixed and require high information security levels. Using cloud platforms as technical support, two distinct hardware platforms for internal and external networks should be established to create conditions for future cloud architecture implementation.

The integrated media service platform comprehensively consolidates news programs, focusing on key businesses such as news content production and multichannel distribution. Positioned on the external network, this platform receives and aggregates online news content pushed from cloud service platforms, providing news production materials for television, broadcasting, and other media outlets. It also supplies interactive news content for news studios and supports news content planning by leveraging massive information resources. Broadcasting and television news systems are integrated into the same scheduling system while maintaining the independence of news broadcasting systems. The news

production and broadcasting platform enables all-media production and audio-video editing, establishing an internet news production system that serves as a rapid editing platform for broadcasting and television. This approach fully considers existing news systems while achieving an internet program production system.

Under cloud architecture, network construction no longer relies on backbone systems, and each production and broadcasting business no longer pursues comprehensive functionality. Instead, the focus is on designing individual news business modules, which are then integrated with the news production platform. Due to security concerns in news production and broadcasting systems, each business subsystem only needs to complete computing and file storage within its own system to achieve network-level security management, which is then overseen by the integrated media news production platform.

3.3 Network Security

Network security for news production and broadcasting requires comprehensive construction from both policy and protection perspectives. First, hardware and software resources within the network should be evaluated based on each news business and network production workflow, security risks should be rated, risk sources should be thoroughly analyzed, and security protection objectives should be defined. Second, corresponding security protection zones should be delineated for different news production and broadcasting business systems to enable comprehensive network information planning. Third, different security systems should be analyzed to establish an all-media news production and broadcasting network security system. Fourth, news production and broadcasting workflows should integrate information collection and retrieval, completing security operations and maintenance alongside business production processes to enable network security monitoring.

4.1 Economic Considerations

The introduction of cloud computing technology into broadcasting systems represents a future development trend. However, whether to adopt cloud architecture to replace traditional news production and broadcasting methods must be determined based on the actual circumstances of each television station. Currently, a common misconception suggests that cloud architecture requires dense blade servers to effectively enhance system performance. Cloud computing services primarily utilize numerous distributed computers rather than local computers, converting resources into applications and accessing computers according to actual news production and broadcasting needs. While cloud architecture integrates hardware resources, it does not demand high-performance single servers. Branded blade server chassis cost hundreds of thousands of dollars, with individual servers approaching nearly one hundred thousand dollars, requiring substantial capital for hardware configuration. From a virtualization configuration perspective, cloud architecture only demonstrates economic benefits at

sufficient scale, making it less cost-effective for small and medium-sized television stations.

4.2 Integration of Private and Public Clouds

To apply public clouds across multiple domains and scenarios, traditional news production and broadcasting systems have typically used closed systems to ensure information security. Under the current background of new media convergence, cloud architecture for news production and broadcasting should also consider television station network security, primarily adopting private cloud approaches. However, analyzing the development direction of cloud architecture for news production and broadcasting reveals a necessary transition from private cloud to public cloud to better conserve resources.

In summary, the emergence of new media and cloud computing technologies has created upgrade requirements for television news production and broadcasting networks to improve news production efficiency and optimize existing workflows. During the upgrade process to cloud architecture, actual television station conditions must be considered, the integration of private and public clouds must be properly addressed, and the advantages of cloud architecture for news production and broadcasting networks must be fully leveraged.

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Note: Figure translations are in progress. See original paper for figures.