International Journal of Information Security and Privacy
Volume 20 • Issue 1 • January-December 2026

Video Data Security Sharing Transmission Mechanism and Best Practices in Cross-Domain Scenario

Xudong Shao
Department of Information Security Technology, The Third Research Institute of the Ministry of Public Security, Shanghai, China

Bo Yang
http://orcid.org/0000-0001-7710-3479
Computer Network Information Center, Chinese Academy of Sciences, Beijing, China & University of Chinese Academy of Sciences, Beijing, China

Zhijie Fan
http://orcid.org/0000-0003-3578-7889
Department of R&D Center, Shanghai Chenrui Information Technology Company, Shanghai, China & Department of Information Security Technology, The Third Research Institute of the Ministry of Public Security, Shanghai, China

Deyang Qu
Operation and Maintenance Department, Institute of Information Technology of National Immigration Administration, Beijing, China

Weichao Hu
Division of Research Management, Research Institute for Road Safety of the Ministry of Public Security, Beijing, China

Shijun Xu
Department of Science and Technology, Traffic Police Detachment of Nantong Public Security Bureau, Nantong, China

Received: June 5th, 2025 | **Accepted:** March 16th, 2026

ABSTRACT

High real-time mobile video stream cross-domain secure transmission and sharing has become a research focus in the field of high-performance and secure communication. In this study, a more efficient method based on combining a zero-copy model with a one-way light transmission mechanisms is proposed. The method contains an effective integrated framework and layered design structure. The latest PF_RING (9.0.0) zero-copy model, memory routing table, multi-queue multi-threading, and related technologies are comprehensively combined to ensure the high-performance cross-domain secure transmission and sharing of video streams. At the same time, to ensure the safe transmission of shared mobile video data between different network domains, both a mobile video surveillance data transmission model and an anti-storage-based covert channel model are proposed. The experimental results show that the performance of the proposed method has increased by at least 10% in throughput, central processing unit utilization, and bit error rate.

KEYWORDS

Video Surveillance Network, Mobile Video Stream Data, Cross-Domain Secure Transmission and Sharing, Zero-Copy Model, Anti-Storage-Based Covert Channel

INTRODUCTION

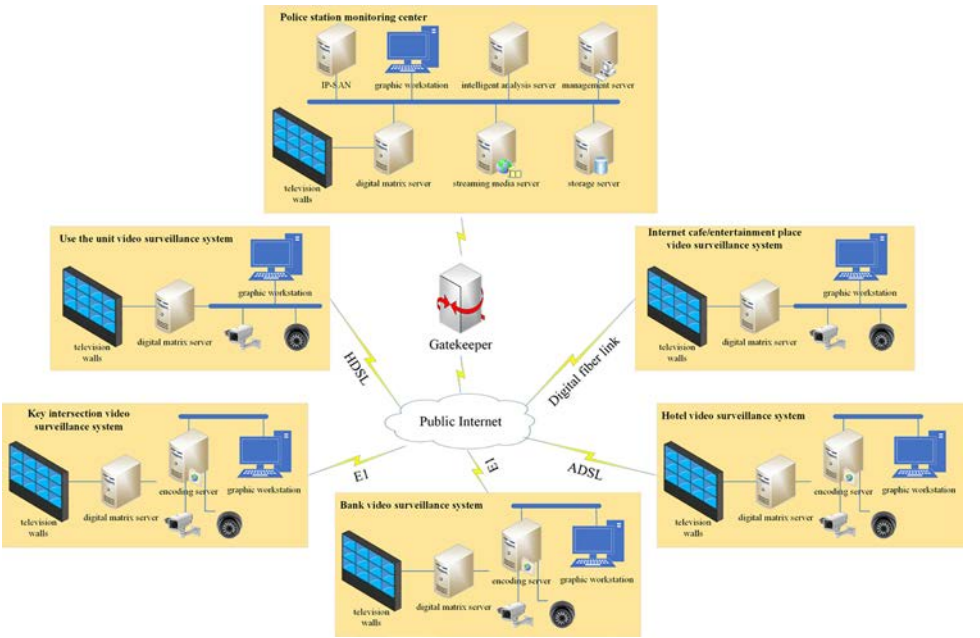
In recent years, video surveillance technology has emerged rapidly along with the development of computers, networks, the Internet of things, big data, cloud computing, and other technologies. As intelligent network video surveillance becomes more popular, video surveillance system will

DOI: 10.4018/IJISP.405407

continue to see exponential growth. According to a report by MarketsandMarkets, a market research and consulting firm in the United States, the global network monitoring market size was estimated to be approximately US$1.67 billion in 2017 and US$1.82 billion in 2018, respectively. Due to the gradual rise in network complexity and security issues, the video surveillance market reached US$2.93 billion in 2023. The video surveillance market is expected to grow to US$76.4 billion by 2027, with a compound annual growth rate of 9.4% between 2022 and 2027.

Video surveillance network systems integrate aspects such as network communications, video coding, computer processing, and software management. Figure 1 illustrates a typical video surveillance network system structure.

Figure 1. Structure of a Typical Video Surveillance Network System



Video services involved in Safe City include bayonet monitoring, key-area video surveillance, drone aerial photography, and emergency command video return. Due to different transmission and deployment modes within each service, it is necessary to integrate the heterogeneous networks carrying different services, synchronize the display on the unified application platform in the command center, and centralize the scheduling and management of video images from different networks.

From the perspective of video service traffic, despite the use of advanced H.265 encoding technology, the widespread deployment of high-definition video cameras and multi-angle monitoring in high-density core areas will still lead to a significant increase in the bandwidth demand of the access network. Stored video resources are often shared between multiple departments. The network must have the ability to carry bursty large bandwidth services when faced with concurrent multi-channel video retrieval, video download, video big data analysis, and other applications. This puts forward new challenges to the forwarding performance of network equipment, cache capacity, and network reliability (Cao, Fan, et al., 2024; Chen, Yang, et al., 2016; Collins, Lipton, et al., 2000; Kalbo, Mirsky, et al., 2020; Wu,Wang, et al., 2016).