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Security And Development Of Modern Computer Networks: A Literature Review On Monitoring, Cyber Threats, And Intelligent Detection Systems

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ABSTRACT

The development of modern computer networks has become a fundamental foundation for the implementation of various digital services in the era of digital transformation. Improvements in network speed, scalability, and integration provide significant benefits for the education, government, industrial, and financial sectors. However, behind these advancements, serious challenges emerge in terms of network security. The increasing complexity of modern network architectures raises the potential for cyber threats that may compromise data confidentiality, integrity, and availability. This study aims to examine the development and security of modern computer networks using a descriptive qualitative approach through a literature review method. Data sources were obtained from scientific articles, academic books, and relevant publications discussing computer networks, network monitoring, cyber threats, and intelligent attack detection systems. The results indicate that cyber threats such as phishing, malware, port scanning, and Distributed Denial of Service (DDoS) remain dominant issues. Network monitoring plays an important role as an early detection mechanism, but it has limitations in handling complex and dynamic attacks. Therefore, the implementation of machine learning-based intrusion detection systems is considered capable of enhancing network security effectiveness. The integration of technology, monitoring systems, and improved user security awareness is a key strategy in building adaptive and sustainable network security systems.

INTRODUCTION

Computer networks are the main infrastructure supporting almost all modern digital activities. Along with the increasing demand for fast and reliable data exchange, computer networks have experienced significant development in terms of technology and implementation scale. According to Yudianto and Noor (2014), a computer network is a system that connects multiple computers to share resources and information. This definition emphasizes that computer networks were initially designed to improve efficiency, while also opening potential security risks.

The development of network technologies such as network virtualization, cloud computing, and the Internet of Things (IoT) has increased system complexity. This complexity directly implies higher vulnerability to cyber threats. Wardana (2020) states that society's high dependence on computer networks is directly proportional to the increasing risk of cybercrime, including data theft and information misuse.

Cyber threats appear in various forms, ranging from technical attacks to user manipulation. Phishing, malware, and DDoS attacks are frequently used to gain unauthorized access or disrupt network services (Muftiadi et al., 2022; Stallings, 2018). Therefore, a comprehensive network security approach is required, covering technological, managerial, and human resource aspects. This study focuses on a literature review regarding the development of modern computer networks, cyber threats, network monitoring, and intelligent attack detection systems as efforts to enhance network security.

RESEARCH METHOD

This study uses a descriptive qualitative approach with a literature review method. This method was chosen to obtain a comprehensive understanding of the development and security of computer networks based on previous research findings. Data sources include academic books, national and international journal articles, and scientific publications relevant to the research topic.

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The research stages consist of identifying literature sources, selecting articles based on relevance and credibility, content analysis, and synthesizing research findings (Sugiyono, 2019). Data analysis was conducted by grouping key concepts, including computer network development, types of cyber threats, network monitoring, and machine learning-based attack detection systems. The analysis results are presented in a systematic narrative form.

Research Process Flowchart

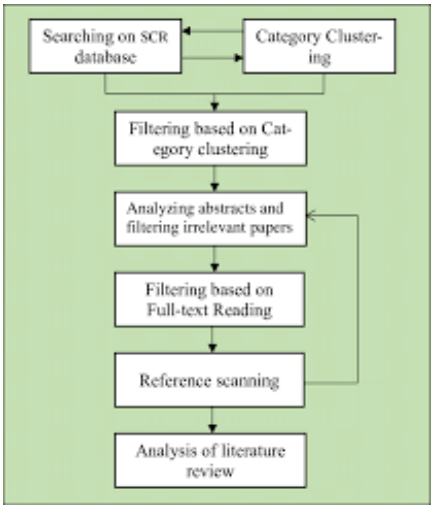

Figure 1. Research Process Flowchart

To clarify the research methodology, this study employs a descriptive qualitative approach using a literature review method. The research process begins with topic identification to determine the focus of the study, followed by the collection of relevant literature from scientific journals, academic books, and credible publications. The collected sources are then selected based on their relevance and credibility to ensure the reliability of the data. Subsequently, content analysis and classification are conducted to identify key concepts related to modern computer network development, cyber threats, network monitoring, and intelligent attack detection systems. The analyzed information is synthesized and interpreted to reveal patterns and significant insights. The results are then systematically compiled and discussed in relation to previous studies and theoretical perspectives. Finally, conclusions are drawn to summarize the findings and highlight their implications for the development of adaptive and sustainable computer network security systems.

RESULTS AND DISCUSSION

Development of Modern Computer Networks

The literature review shows that modern computer networks are evolving toward more complex and integrated architectures (Army et al., 2022; Tanenbaum & Wetherall, 2019). The adoption of cloud computing, virtualization, and wireless networks increases system flexibility and efficiency. However, these developments also expand the attack surface that can be exploited by cybercriminals.

Cyber Threats in Computer Networks

Cyber threats are a major issue in modern computer network management. Phishing attacks exploit user weaknesses, while port scanning and malware exploit technical vulnerabilities in systems (Anif et al., 2015; Wajong, 2012). Previous studies indicate that many cyberattacks begin with network reconnaissance before the main attack is executed.

Role of Network Monitoring

Network monitoring functions to observe network performance and activities in real time (Widodo, 2017). Monitoring systems enable administrators to detect anomalies and disruptions at an early stage. Nevertheless, conventional monitoring approaches have limitations in identifying complex and adaptive cyberattacks.

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Intelligent Attack Detection Systems

The application of machine learning in intrusion detection systems has proven to improve the accuracy of cyber threat identification (Uzlah et al., 2024; Scarfone & Mell, 2012). Methods such as Random Forest and Neural Networks can automatically and adaptively analyze network traffic patterns. The integration of network monitoring and intelligent detection systems represents a promising approach to modern network security.

CONCLUSION

Based on the literature review, it can be concluded that the development of modern computer networks brings significant benefits along with serious security challenges. Cyber threats continue to evolve in line with increasing network complexity. Network monitoring plays an important role as an early detection mechanism but must be supported by machine learning-based attack detection systems. The integration of technology, security management, and improved user literacy is essential for building adaptive and sustainable computer network security systems.

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