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ANALYSIS DEVELOPMENT AND DESIGN OF LOCAL AREA NETWORK: SYSTEMATIC LITERATURE REVIEW

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Abstract: The development of information technology is very important, especially in computer networks. The lack of information related to the development of computer networks, particularly Local Area Networks (LAN), necessitates this research to improve network performance. Therefore, this necessitates analysis and planning of computer networks in offices and companies, which has been done previously. This study aims to evaluate the application of computer networks, particularly the development of LAN in previous studies. The solution to this problem is one of the factors behind this study. Meanwhile, the research method used is Systematic Literature Review (SLR) using journals published in 2022–2025 from Google Scholar. The results of the research obtained are references in the form of advantages, disadvantages, and recommendations for development in the majority of schools. Therefore, this study emphasises the importance of technological development as the basis for internet implementation. Thus, the conclusion is that the use of LAN networks is highly recommended for use in institutions, one of which is educational institutions or schools.

Keyword: internet; local area network (LAN); technological development

Abstrak: Perkembangan teknologi informasi sangat penting terutama pada jaringan komputer, minimnya informasi terkait perkembangan jaringan komputer khususnya Local Area Network (LAN) membuat diperlukannya penelitian ini untuk meningkatkan performa jaringan. Oleh karena itu hal tersebut melatar belakangi diperlukannya analisis dan perencanaan pada sebuah jaringan komputer pada kantor maupun perusahaan yang telah dilakukan sebelumnya. Penelitian ini bertujuan untuk mengevaluasi penerapan Jaringan Komputer utamanya pada perkembangan LAN pada penelitian sebelumnya. Solusi dari permasalahan tersebut menjadi salah satu factor dilakukannya penelitian ini. Sedangkan, metode penelitian yang digunakan yaitu Systematic Literature Review (SLR) dengan menggunakan jurnal yang terbit pada 2022 – 2025 dari Google Scholar. Hasil penelitian yang didapatkan adalah referensi berupa keunggulan, kelemahan, dan rekomendasi perkembangan pada mayoritas sekolah. Oleh karena itu, penelitian ini menekankan pentingnya perkembangan teknologi sebagai dasar dalam penerapan internet. Maka dari itu kesimpulannya bahwa penggunaan jaringan LAN sangat direkomendasikan untuk digunakan pada instansi salah satunya adalah instansi pendidikan atau sekolah.

Kata kunci: internet; local area network (LAN); perkembangan teknologi

INTRODUCTION

The development of computer network technology is currently advancing very rapidly, therefore knowledge of computer networking is necessary. The operating system on a client-server network helps to enable the network to centralize the use of an application to one or more dedicated file servers on a network. A file server will be the heart of the entire system and will provide access to resources that will provide security. A stand-alone workstation can retrieve resources contained in files that are used within an area or building that is approximately 1 km away. (Sumbaryadi et

al., 2022) This network can be used to connect networks located in areas that are not too far apart, such as within a building or complex with a maximum distance of 10 kilometers and a relatively high data transfer speed of approximately 10 to 100 Mbps. LAN is designed to enable the simultaneous use of resources between existing personal computers or workstations. (Kurniawan et al., 2023) Many IEEE 802.3 Ethernet-based Local Area Networks use switches with data transfer speeds of 10, 100, or 1000 Mbit/s. (Kabenarang et al., 2022) A Local Area Network is a private network within a building or institution that can span several kilometers. LANs are often used to connect personal computers and workstations within an institution or company to share and exchange information (Jeanne Clarisa Wetik, Wiliani, 2023).

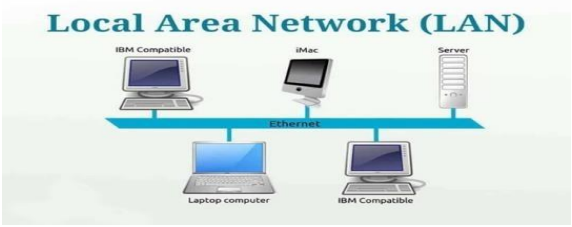

Image 1. Local Area Network (LAN)

LITERATURE REVIEW

Previous similar research involved combining the Netsupport application with a Local Area Network (LAN). The benefit of this was that Netsupport School could monitor students' computers by displaying them on the teacher's screen, allowing teachers to monitor and control the computers used by students, making it more practical and effective.

The research methodology used in this study was Research and Development (RnD) (Rio & Musril, 2022). Another study discussing Local Area Networks (LAN) is the analysis and design of computer networks at SMK Negeri 2 Bitung using the Cisco Packet Tracer application or software. The design was carried out by considering the needs of the school. The school has two different network access points, each with its own standards (Amala & Mewengkang, 2023).

The third study shows the Network Forensic Investigation Framework, which was designed to facilitate the investigation process when a network attack occurs. The Intrusion Detection System (IDS) is a system that can record activities that disrupt the computer network in the event of a network attack. The IDS also functions to identify the type of attack on the computer network in the form of alerts (Widodo & Aji, 2022).

The next study explains the irregularity of IP addresses at SMK Bina Karya due to the use of dynamic IPs. In addition, the untidy arrangement of cables can affect work activities. This arrangement aims to avoid IP conflicts. Then, a hub device was added to act as an intermediary between the server computer and the router (Dharmalau et al., 2022). Further research conducted by SMAN 13 Padang aimed to utilize the facilities of the wifi hotspot service for schools so that students could access learning materials in the form of images, videos, content, animations, and others.

The availability of Wi-Fi hotspot facilities also helps spread internet access throughout the school area with an IoT base. The results of the analysis and evaluation of LAN network development at SMA N 13 Padang provided very positive benefits and impacts, supporting the learning and teaching process with 93% internet facility usage traffic and 400 Mbps internet capacity usage in the school's academic environment. (Putra et al., 2022).

Previous research focused on the development and implementation of a website-based computer and network technician service booking system with an Internet of Things (IoT) concept to make it easier for customers to book services online, record repair history, and accelerate and streamline services between customers and technicians through flexible and accurate internet access (Sari et al., 2022). The SLR method is important because with this method, the author wants to find out about the strengths, weaknesses and developments of previous research.

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METHOD

This research method uses the Systematic Literature Review (SLR) model. The research is based on several previous research sources whose subchapters discuss Local Area Network computer networks. The purpose of using the SLR method is to search for or find and trace literature on previous research using structured and systematic procedures. The process involved relates to the process of recognizing, identifying, and evaluating all research that has been conducted by previous researchers. The type of research used is qualitative research by integrating various sources of literature research that has been conducted by previous studies. The systematic search was conducted using Google Scholar. The keywords used included "SLR," "Network Analysis and Design," "Computer Network," and "Local Area Network." Table 1 below explains the classification of keywords used in this study.

Table 1. Keyword Search Classification

Keywords	Keyword Search Results
SLR Local Area Network	61

The publication year used to limit the search results is from the range of 2022-2025. Restrictions were imposed on the clustering of literature reviews on computer networks, namely: (1) Implementation of the SWOT Method in Local Area Network Analysis in Schools. (2) Analysis and Design of Computer Networks at SMK Negeri 2 Bitung. (3) Designing a Local Area Network (LAN) at SMK1 Kepahiang School. (4) Analysis and Design of a Wireless Local Area Network at SMK. (5) Analysis and Development of Computer Networks at SMK Negeri 8 Weda Halmahera Tengah.

Flowchart

This flowchart outlines the Systematic Literature Review (SLR) methodology conducted on Local Area Networks. The process begins with data collection using Google Scholar as the primary database, where an initial search yielded 61 articles. These sources underwent a detailed data analysis phase focusing on completeness, advantages, disadvantages, and research development methods, ultimately narrowing the selection down to 20 key articles to produce the final results. The following is a flowchart display in Image 2.

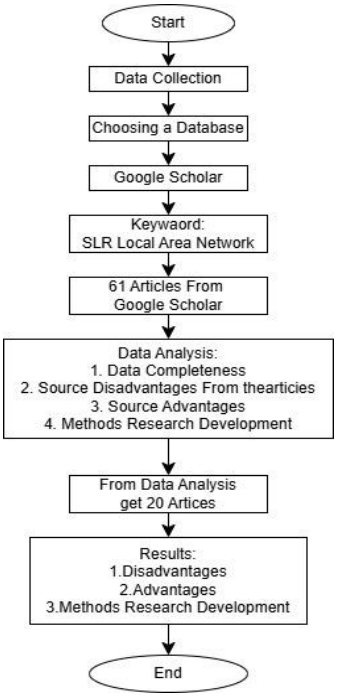

Image 2. Flowchart of data collection and analysis

The flowchart in Image 2 explains that the research began by first collecting data from Google Scholar for the years 2022–2025. Google Scholar was chosen because many research references are uploaded to this database. The next step was to enter the keyword SLR Local Area Network. After that, 61 articles appeared from Google Scholar. Then, an analysis was conducted by considering several parameters, namely (1) Completeness of data; (2) Sources of weaknesses in the articles; (3) Sources of weaknesses in an article; (4) Methods of technological development. The next step yielded results in the form of selecting 20 articles. The results obtained were (1) Weaknesses; (2) Strengths; and (3) Technology Development Recommendation Methods.

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The scope selected for this study focuses on schools or educational institutions. This was chosen because educational institutions require an internet network for learning purposes.

RESULT AND DISCUSSION

Table 2 explains previous studies related to the discussion of networks, namely:

Table 2. Systematic Literature Review (SLR)

No	Author	Article Title	Benefits	Barriers	Development Recommendations
1.	Roma Rio and Hari Antoni Musril (Rio & Hari, 2022)	Local Area Network Design *Local Area Network* as a Learning Monitoring Tool in Computer Laboratories	1. Improving learning effectiveness 2. Facilitating student supervision 3. Saving teachers' time and energy	1. Limitations of initial infrastructure 2. Limitations of computer equipment 3. Physical monitoring constraints Laboratory space	1. Development of a broader and more stable network 2. Technical training for teachers 3. Integration with digital learning systems
2	Risanto Amala, Alfrina Mawengkang, and Arje Cerullo Djamen (Risanto Amala, Alfrina Mewengkang, 2021)	Implementation of the Internet of Things Based on Website in Ordering Computer Technician Home Service and Network Services	1. Ease of access to services 2. Time and labor efficiency 3. Service history recording	1. Dependence on internet connection 2. Limitations of IoT features 3. Data security	1. Broader IoT integration 2. Mobile application development 3. Improved system security
3	Tri Widodo and Adam Sekti Aji (Widodo & Aji, 2022)	Utilization of *Network Forensic Investigation Framework* to Identify Network Attacks Through *Intrusion Detection System* (IDS)	1. Application IDS can detect attacks such as *network scanning* and DOS. 2. Facilitates the attack detection process 3. Process of receiving responses in the form of *alerts.*	1. Limitations of IDS rules 2. Simulation small networks 3. IDS detection is still reactive 4. System The IDS is not yet connected to other security systems systems	1. Integration with AI 2. Integration IDS with *firewalls, antivirus,* and log *management* systems 3. Implementation in large-scale network environments 4. Network administrator training
4.	Andy Dharmalau [1)],Harun Ar-Rasyid[2], Muhammad Affan Iskandarsyah[3] (Dharmalau et al., 2022)	Implementation of the SWOT Method in Local Area Network Analysis of Schools	1. LAN facilitating data printing and data exchange 2. Improving learning effectiveness 3. Supporting connectivity between rooms with STAR topology.	1. IP address issues Which often cause IP *conflicts* 2. Limited number of experts 3. Layout cable Cable is not organized 4. Performance network performance is unstable	1. Use of static IP addresses 2. Reorganization of network cables 3. Addition of new hubs or switches 4. Development to wireless technology (Wi-Fi).

No	Author	Article Title	Benefits	Barriers	Development Recommendations
5.	Syaflan Sandi Harta, Ambiyar, Wakhidnuddin and Nizwardi Jalius (Putra et al., 2022)	Evaluation of the Effectiveness of LAN Network Infrastructure Development LAN and Internet Infrastructure Development on the School Activation Program at SMAN 13 Padang	1. Supportin school digitization 2. Improving learning effectiveness 3. Fast internet Access and equitable	1. Potential of internet misuse 2. Dependence of students on the internet 3. Need for improved digital literacy	1. Strengthening network management and control systems 2. Developmen of IoT-based infrastructue 3. Improving human resource capacity
6.	Indah Purnama Sari 1Ismail Hanif Batubara [2], Mhd. Basri [3] ,Al Hamidy Hazidar [4] (Sari et al., 2022)	Implementation of the *Internet of Things* Based on Website in Ordering Computer Technician Home Service and Computer Network Services	1. Simplifying the online booking of technician services online 2. Efficiency in service scheduling 3. Improved Accuracy and service speed	1. Not yet using hosting and domain 2. Limitations of IoT implementati on that are not yet fully 3. Lack of features In user data security 4. Limited resources 5. Power and testing	1. Website need to be Be uploaded to hosting and an active domain 2. Integration of sensors with system development 3. Application developmentmobile app 4. Security enhancement in the system
7	Hendi Suhendi[1] ,Harya Gusdevi[2] (Suhendi & Gusdevi, 2023)	Design of *Wide Area* Computer Networks Using MPLS *(Multi Protocol Label Switching)*	1. Improving data transmission efficiency 2. Ensuring network stability and network security 3. Automatic selection of the best route 4. Improved service quality of services based on parameters such as throughput, delay, jitter, and round-trip time.	1. Limitations of the simulation environment using *Cisco Packet Tracer* 2. MPLS requires a router device and a switch 3. No field performance tests have been conducted 4. Limitations Additional security	1. Direct implementat on in the company 2. IDS/IPS firewall integration 3. QoS optimization and traffic management 4. Human resources training and network documentation 5. Evaluation of network performance on a regular basis
8	Wira Buana [1)], Andriyas Hariyandi [2*)], Faeza Rezi S [3)] (Buana et al., 2023)	Network Development *Local Area Network* (LAN) and *Wide Area Network* (WAN) at SMKN 4 Padang using the Research and Development	1. Improving communication efficiency with LAN and WAN networks 2. Improving Security and data management Improving 3.Operational efficiency with time efficiency time.	1. Limitations of the initial infrastructure 2. Hardware limitations with good performance 3. Limitations Human resources 4. Budget constraints and maintenance	1. Hardware capacity upgrades 2. Network Network infrastructure 3. Training and certification of human resources 4. Integration security systems

No	Author	Article Title	Benefits	Barriers	Development Recommendations
9	Entin Monika [1)], Fitriah [2)](Monika & Fitriah. Fitriah, 2025)	Local Area Network Design *Local Area Network* (LAN)in Kepahiang Vocational School1	1. Improving efficiency with a STAR topology LAN 2. Supportin learning activities 3. Developing the school's school digital systems	1. Limitations of initial infrastructure 2. Cost constraints 3. Limited human resources 4. Lack of security layers Additional	1. Addition of security features 2. Infrastructure improvements 3. Implementation of network monitoring systems
10	Dedy Ariyadi[1] , Sayekti Harits Suryawan[2] (Ariyadi & Suryawan, 2024)	Analysis and Design of *Local Area Network* (LAN) at the Computer Laboratory of Long Iram State Senior High School1	1. LAN can facilitate access learning resources 2. LAN Star topology improve the effectiveness of ANBK activities 3. LAN 4. Facilitates data management, connectivity between computers, etc.	1. Relocation design of the lab space 2. Limitations of equipment and infrastructure Budget constraints	1. Selection of topology characteristics and infrastructure selection 2. Regular maintenance 3. Upgrading device specifications to a higher level 4. Evaluation and routine testing
11	Bisma Wirajovi Aulia[1)], Muhamad Rizki[2)], Priki Prindiyana [3)], Surgana[4)] (Aulia et al., 2023)	The Role of Computer Networks and Databases in the Digital Age	1. Improving communication efficiency and information exchange 2. Supporting effective data management Supporting data-driven decision making	1. Data security and privacy 2. Data volume that continues to increase 3. Network infrastructure limitations	1. Data security and privacy 2. Increasing data volume 3. Network infrastructure limitations
12	Edwar Rosman[1] , Hidra Amnur[2] ,Katrina Flomina[3] , Miftahul Hasanah[4] , Riyan Ikhbal Salam[5],Dian Eka Putra[6] , Naufal Dzaki [7] (Rosman et al., 2024)	Computer Network Installation as a Support for Community Administration Services in Bomas Village	1. Improving the efficiency of community administrative services 2. Supporting the shared use of devices 3. Improving literacy 4. Of employee and the community	1. Lack of adequate computer network infrastructure 2. Limited employe expertise 3. The are still manual	1. Continuous training 2. Scheduling of network maintenance on a regular basis 3. Network infrastructure improvement
13	Andy Satria [1],Fanny Ramadhani 2(Satria & Ramadhani, 2023)	Computer Network Security Using Switches Port Security On Cisco Packet Tracer	1. Improving local area network (LAN) security (LAN) 2. Preventing network misuse 3. Maintaining network stability	1. Configuration requiring technical expertise 2. Limited scalability 3. Potential configuration errors	1. Integration with dynamic authentication systems 2. Implementation of real-time monitoring in real time 3. Training for network administrators

No	Author	Article Title	Benefits	Barriers	Development Recommendations
14	Dedes Asriani Siregar[1], Mutiara[2]Nenni Faridah Lubis[3], Ahmad Bay Haqi[4], Anggi Zumaidil Akhir[5] (Siregar et al., 2023)	Introduction to Basic Computer Networks at SMK Negeri 1 Batang Onang	1. Improving student knowledge 2. Fostering interest In learning 3. Improving 4. practical skills	1. Lack of similar activities in the past 2. Limited facilities and practical tools 3. Short implementation time	1. Need for advanced training 2. Increasing practice facilities 3. Increasing the frequency of PKM activities
15	Dafwen Toresa1, Pandu Prama Putra[2], Bayu Febriadi[3], Susi Handayani[4] (Toresa et al., 2023)	Basic Computer Network Training for Vocational High School Students Riau Innovation	1. Enhancing students' practical skills 2. Increasing motivation and readiness of students 3. Improving conceptual understanding of basic networking and the internet	1. Limitations of computer devices 2. Large number of participants 3. Low initial understanding Low	1. Continuing training to the advanced stage 2. Adding computer network practice equipment 3. Conducting training on creation Website and multimedia
16	Tikaridha Hardiani [*1], Esi Putri Silmina[2], Danur Wijayanto[3](Hardiani et al., 2023)	Computer Network Training Using Cisco Packet Tracer at SMK Ar Rahmah Bantul	1. Enhancing students' knowledge and skills of students 2. Developing analytical and problem-solving skills 4. Boosting students' self-confidence	1. Lack of prior knowledge among students 2. Computer network material taught at school is still limited 4. Students' lack of experience in using Cisco Packet Tracer,	1. Conducting advanced training 2. Increasing practice hours and the number of training sessions 4. Integrating Cisco Packet Tracer into regular TKJ learning
17	Hasri Awal[1)], Aggy Pramana Gusman[2] (Awal & Gusman, 2023)	Implementation of Intrusion Detection Prevention System as a Computer Network Security System for the Pariaman District Attorney's Office Using Snort and Linux-Based IPTables	1. Enhancing computer network security 3. IDS (Snort) successfully detects attacks in real time IPS (IPTables) is capable of blocking attackers' IP addresses automatically	1. Lack of a previous network monitoring system 2. No automatic security configuration 3. Requires special technical expertise	1. Developing an IDPS continuously 2. Conducting technical training for network administrators 3. Adding a dashboard-based monitoring system.
18	Yehezkiel Saputra Wanggi[1], Fajar Hariadi[2] (Wanggi & Hariadi, 2023)	Computer Network Bandwidth Management at Rambangaru Community Health Center Using Mikrotik Hotspot	1. Improving computer network quality 2. Fairly distributing bandwidth 3. Improving the efficiency of administrative and medical services	1. Limitations of the initial network infrastructure. 2. Not yet no bandwidth allocation settings 3. Technical adjustments are needed to	1. Developing an automatic bandwidth management system 2. Increasing network capacity and Mikrotik devices 3. Implementing a real-time network

No	Author	Article Title	Benefits	Barriers	Development Recommendations
				the configuration Mikrotik	
19	Arief Budi Pratomo (Pratomo, 2023)	Development of a Firewall System on Mikrotik RouterOS-Based Computer Networks	1. Improving computer network security 2. Firewalls can block dangerous ports 3. Adding hotspot user authentication	1. Weaknesses in the initial network infrastructure 2. Network devices (such as Tenda access points) 3. Lack of bandwidth management and security systems security	1. Adding a firewall automation system 2. Enhancing monitoring with a real-time dashboard, 3. Training campus network administrators
20	Memed Saputra, Ahmad Rufa'i, Najmuddin (Saputra et al., 2023)	Computer Network Technology Using the Virtual Local Area Network (VLAN) Method	1. Simplifies computer network management 2. Improves network security 3. Optimizing the use of network devices	1. The VLAN configuration process is technical and complex 2. Challenges in testing communication between VLANs 3. Limitations of simulation equipment	1. Adding inter- VLAN routing features 2. Integrating VLANs With firewalls and access control lists (ACLs) 3. Performing re al-world implementation tests in the campus environment or company

The following explanation from Table 2 can be summarised as follows:

These obstacles most often arise in various studies, particularly in educational institutions and public services. Forms of obstacles: (i) Limited initial network infrastructure; (ii) Low-specification computer and network devices; (iii) Limited number of switches, routers, access points, and servers; (iv) Untidy cable layout; (v) No active hosting and domain on website-based systems

The second obstacle is human resources, which is a dominant factor affecting the success of network implementation. Forms of obstacles: (i) Limited network experts; (ii) Lack of technical skills among network administrators; (iii) Minimal user experience (teachers, students, employees); (iv) Low initial understanding among users.

The third obstacle is network and data security. Security aspects are an important challenge as the use of networks and the internet increases. Forms of obstacles: (i) Lack of additional security systems (firewall, IDS/IPS); (ii) IDS is reactive and not yet integrated; (iii) User data security is not yet optimal; (iv) Potential for internet abuse (phishing, spam, illegal access).

Based on the results of a review of various studies in the Systematic Literature Review Table, it can be concluded that the development and implementation of computer networks has significant advantages for educational institutions, public services, and organisations. The implementation of LAN, WAN, and supporting technologies such as IoT, IDS, VLAN, and bandwidth management has been proven to improve communication and data exchange efficiency, accelerate information access, and support the digitisation of work and learning processes. In addition, computer networks enable the shared use of resources, such as hardware, data, and internet services, thereby saving time, energy, and operational costs. Other advantages include

improved learning and administrative service effectiveness, network stability and security, ease of system monitoring and management, and support for data-driven decision making. Overall, the implementation of a well-planned computer network contributes significantly to improving productivity, service quality and institutional readiness in facing developments in digital technology.

CONCLUSION

Based on 20 previous studies discussed in this research, it is clear that the use of technology is very important, especially when used for institutional or corporate purposes. The awareness that users have urgent and immediate needs requires exploration of things that are useful for the work process. The benefits of technology can result in system upgrades, cloud computing, Software Defined Networking, network function virtualization, and the Internet of Things.

Computer networks are very important for organizations or agencies in order to achieve their goals through the process of upgrading existing technology. There are many things that need to be considered in terms of supporting factors and important aspects in achieving a good network in an agency or company. A good company or agency cannot do without the help of a good network to send data or information more quickly. The supporting factors for achieving a good network in an agency or company are people, ergonomics, network tools and materials, ease of access to technology, and usability for users. The benefits of using a computer network include: (1) Resource Sharing (2) Increased Efficiency (3) Increased Productivity (4) Reduced Costs (5) Increased Security (6) Enabled Communication (7) Access to Information (8) Increased Flexibility. Obstacles that may arise regarding the use of computer networks in agencies and companies are (1) Network Security (2) Dependence on Technology (3) Costs (4) Compatibility (5) Management (6) Dependence on the Internet (7) Phishing and Spam Attacks (8) Hardware Damage (9) Configuration Errors (10) Bandwidth Limitations.

Not only that, but there are also recommendations for development in improving everything that already exists, including: (1) Improving Network Security (2) Increasing Network Capacity (3) Improving Network Availability (4) Improving Network Management (5) Improving Network Speed (6) Improving Data Security.

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