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Redesign of The Wireless Local Area Network (WLAN) at the Provincial Library Office of South Sumatra

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Abstract: The design of the Wireless Local Area Network (WLAN) at the South Sumatra Provincial Library Service (DISPUSTAKA) aims to evaluate the current internet connectivity performance. Currently, DISPUSTAKA provides Wi-Fi internet services for office use and within the provincial library facilities. Network connectivity testing is conducted using the Quality of Service (QoS) method with the help of applications such as Axence NetTools. The connectivity test aims to determine the actual speed and performance level of the Wi-Fi service provided by DISPUSTAKA. The collected QoS data are analyzed using the Action Research method. The design process begins with a needs analysis, including identifying the number of users, types of devices used, and the coverage area. A site survey is then carried out to understand the building layout and identify potential physical barriers that may affect Wi-Fi signal propagation from the Access Point devices. Based on these findings, the researcher proceeds to redesign the existing WLAN to provide more reliable and stable connectivity services, thereby improving internet performance to support the operations of the South Sumatra Provincial Government.

Keywords: WLAN, Axene NetTools, Action Research

Introduction

The rapid advancement of information and communication technology has driven various government institutions, including libraries, to strengthen their digital infrastructure in order to support faster, more efficient, and easily accessible public services (Dwinanda, 2021). One of the key components in this transformation is the implementation of a Wireless Local Area Network (WLAN), which provides wireless internet access for both employees and visitors. At the South Sumatra Provincial Library Office (DISPUSTAKA), the WLAN plays a crucial role in supporting information technology–based services such as access to e-books, online catalogs, internal administrative systems, and digital literacy programs. Through this network, visitors can search for scientific references, access digital collections, and utilize various internet-based facilities, while staff can manage member databases, operate circulation systems, and communicate effectively across departments (Iii, 2016).

However, the growing number of users without sufficient network capacity and configuration has led to several issues, including unstable connections, weak signal coverage in specific areas, and congestion caused by simultaneous high user activity (Abdillah, 2019) (Kurose & Ross, 2021) (Nugraha & Hidayat, 2020). These challenges reduce

digital service quality, delay administrative processes, and disrupt user experience in accessing digital resources ((Bobanto et al., 2014) To overcome these issues, a redesign of the WLAN network is essential to improve performance, speed, and reliability while expanding signal coverage throughout the library building (Hariyadi, 2009).

The redesign process began with Quality of Service (QoS) testing using Axence NetTools to measure primary parameters such as delay, packet loss, and throughput as indicators of connection quality (Alamsyah et al, 2017) (Sudarta, 2022) The test results served as a foundation for developing a new, more efficient network topology that considers user demand, the number of active devices, and physical barriers affecting wireless signal distribution. The redesign included adding multiple access points in high-traffic areas, reconfiguring routers, and enhancing network security systems to ensure data protection and mitigate cyber threats (Andriana et al, 2019).

This research aims to produce a redesigned WLAN network that performs better than the previous one—featuring faster, more stable, and more secure connectivity. The findings of this study align with prior analyses of internet service performance and network optimization (Anisa et al, 2023), emphasizing the importance of consistent monitoring, technical adjustments, and efficient topology design in improving service quality(Cisco Systems, 2022; Kementerian Komunikasi dan Informatika Republik Indonesia, 2023). Ultimately, the redesigned WLAN is expected to enable the South Sumatra Provincial Library Office to deliver more effective digital services, enhance user satisfaction, promote public literacy, and contribute to the realization of a modern, technology-based, and sustainable e-government framework.

Methodology

This study was conducted at the Library Office (DISPUSTAKA) of South Sumatra Province to analyze and improve the performance of the Wireless Local Area Network (WLAN). The research was carried out over four months, from October to January 2025, covering stages of observation, data collection, network analysis, and system redesign to optimize internet connectivity. The data collection method used was observation, which involved direct monitoring of the network's condition on-site to obtain real information regarding activities, technical issues, and connection quality. Observation was performed using sensory perception to understand the actual phenomena occurring at the research location (IEEE, 2020) (International Telecommunication Union, 2019).

The research method applied was Action Research, focusing on solving real-world problems through direct action and subsequent evaluation. The analysis was conducted based on Quality of Service (QoS) parameters, namely Delay, Packet Loss, and Throughput, using the Axence NetTools application. The research process consisted of four main stages: (1) Diagnosis (Diagnosing) — identifying the primary issues in the WLAN network; (2) Planning (Action Planning) — formulating strategies and designing a new network topology; (3) Implementation (Action Taking) — conducting QoS measurements for twenty days using routers, access points, and laptops; and (4) Evaluation (Evaluation) — comparing measurement results against TIPHON standards to assess network quality and determine factors affecting WLAN performance (Doloksaribu, 2019)(ETSI TIPHON, 2021).

Result and Discussion

1. Analysis (Diagnosing)

The WLAN network at the South Sumatra Provincial Library Office is utilized by staff for library system operations and administrative activities, as well as by visitors (students and researchers) for accessing digital references and conducting online learning. However, the increasing number of users has led to unstable connections, uneven signal distribution, and network device overload (Cisco Networking Academy, 2024; Jain, 2020; National Institute of Standards and Technology, 2023).

To evaluate network performance, a Quality of Service (QoS) test was conducted using the Axence NetTools application, focusing on three parameters: delay, packet loss, and throughput. The following table presents the results of the five-day QoS measurement on the first floor, showing poor performance across all parameters.

Table 1. Current QoS Measurements Over 5 Days

Day/Date	Delay (ms)	Packet Loss (%)	Throughput (kbps)
Monday, October 7, 2024	320	30	0.8
Tuesday, October 8, 2024	290	25	1.0
Wednesday, October 9, 2024	310	28	0.9
Thursday, October 10, 2024	350	35	0.7
Friday, October 11, 2024	300	27	1.1

The WLAN performance measurement at the South Sumatra Provincial Library over five days indicated that network connectivity was still suboptimal. On the first day, the delay reached 320 ms with a packet loss rate of 30% and a very low throughput of only 0.8 Mbps, reflecting poor network quality. The second day showed slight improvement, but the delay remained high at 290 ms with 25% packet loss. Similar conditions occurred on the third day, where the delay was still high (310 ms) and packet loss reached 28%, while throughput only slightly increased to 0.9 Mbps. On the fourth day, network performance hit its lowest point, with a delay of 350 ms, the highest packet loss of 35%, and a decrease in throughput to 0.7 Mbps. The fifth day showed minor improvement, with throughput reaching 1.1 Mbps, but the delay (300 ms) and packet loss (27%) remained far from ideal standards. Overall, these results indicate that the WLAN network has not yet provided reliable service quality, thus requiring evaluation and redesign to enhance connectivity performance (Dunkel Schetter & Tanner, 2021).

2. Action Planing

In the second stage, the researcher developed an action plan to address network issues by preparing the necessary hardware and software and designing a new network topology. The hardware used consisted of one laptop for collecting Quality of Service (QoS) data parameters, namely delay, packet loss, and throughput. The software included Windows 11 as the operating system, Axence NetTools 5 Professional for measuring QoS parameters, and Microsoft Visio for designing the network topology (Gartner Research, 2023) (Yusriadi & Suryadi, 2021).

The new topology design involved adding two access points in the visitor service area, which has the highest level of activity, such as book borrowing and returning. The main objective was to expand signal coverage and improve connection stability so that both visitors and staff could access the network optimally. This addition also helped distribute the network load across multiple devices—including staff computers, barcode scanners, and visitors' devices—thereby reducing the risk of slow or disconnected connections. Beyond improving user convenience, this step serves as a long-term strategy to strengthen the network infrastructure, ensuring it can accommodate future increases in user numbers and growing digital demands.

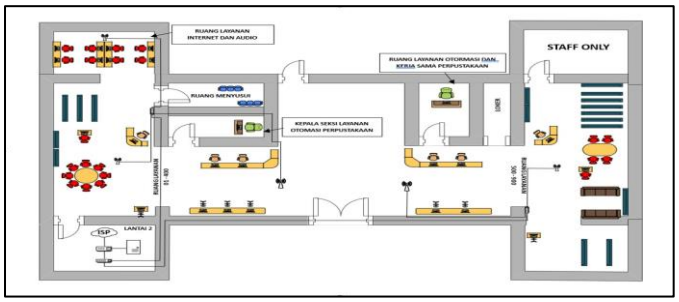

Figure 1. New First Floor Topology Design

3. Implementation (Action Taking)

The measurement results for the delay parameter show that the average value from 40 measurements over 20 days ranged around 3 ms, with a minimum of 1 ms and a maximum of 198 ms. According to the TIPHON standard, all results fall into the "very good" category (<150 ms). Measurements were conducted during peak hours (12:00–13:00 WIB) and off-peak hours (09:00–10:00 WIB) on the second floor of the South Sumatra Provincial Library Office. These findings indicate that the wireless network has a low transmission delay and stable connection performance, even with varying levels of user activity.

For the packet loss parameter, the results showed an average between 0% and 21%, with most tests within the 0–2% range, categorized as very good by TIPHON. Only a few instances reached the "fair" category, likely due to network collision or congestion when the number of users increased. Overall, this demonstrates that data packet loss on the network is minimal, ensuring efficient data transmission without significant user disruption.

Meanwhile, the throughput measurements recorded an average value of 6.964 kbps, ranging from 76 kbps to 3.935 kbps, which falls under the "very good" category (>2.1 Mbps) according to TIPHON standards. This indicates that the network's data transfer capability is high, both during peak and off-peak hours. In summary, the results of the three QoS parameters — delay, packet loss, and throughput — confirm that the internet network performance at the South Sumatra Provincial Library access point is optimal, effectively supporting users' data access needs (Rahman & Puspitasari, 2023) (Suherman & Widodo, 2020) (World Bank, 2024).

4. Evaluation (Evaluation)

The QoS measurement results at the South Sumatra Provincial Library showed significant improvement after network optimization. In the initial measurement, the delay value reached 320 ms (classified as "fair" under TIPHON), indicating high latency due to network congestion and suboptimal infrastructure. This caused noticeable lag in accessing digital services. However, after the network redesign and optimization, the delay value dropped to 2 ms ("very good"), showing that the network became faster and more efficient in data transmission.

For the packet loss parameter, the initial measurement recorded 30% ("poor"), which caused disruptions to online-based services such as the digital catalog and e-library systems. After the improvements, the measurement showed 0% packet loss ("very good"), indicating a significant increase in connection stability and smoother access to digital services.

Meanwhile, the throughput value at the beginning of measurement was 0.800 kbps ("fair"), reflecting low data transfer speed and poor user experience. After optimization, throughput increased to 6.964 kbps ("very good"), meaning that data access and transfer speeds improved considerably. Overall, these results confirm that the network improvements successfully enhanced QoS performance, allowing users to experience a faster, more stable, and more efficient connection

Conclusion

Based on the network quality measurements at the Provincial Library Office of South Sumatra, there was a significant improvement in WLAN performance after the network redesign. Initially, high delay values indicated slow data transmission and poor responsiveness, while elevated packet loss reflected unstable connections and incomplete data delivery. After optimization, delay was significantly reduced, packet loss minimized, and throughput increased to a stable and high level, resulting in faster and more reliable access to the library's digital services. To maintain this performance, continuous network monitoring, stronger authentication and encryption, proper access point placement, user education on correct network usage, and regular QoS evaluations are recommended to ensure long-term stability, security, and efficiency of the library's WLAN system.

References

Abdillah, L. A. (2019). Manajemen Infrastruktur Teknologi Informasi di Lingkungan Pemerintah Daerah. *Jurnal Teknologi Informasi Dan Komunikasi Pemerintahan*, *8*(2), 34–45.

Alamsyah, H. M., Abdillah, L. A., & Purnamasari, S. D. (2017). Redesign Jaringan Komputer Internet dan Intranet pada PT Sekawan Kontrindo. *Bina Darma Conference Series on Computer Science*, 109–114. http://eprints.binadarma.ac.id/3767/

Andriana, M., Fatoni, & Ibadi, T. (2019). Desain Jaringan WLAN RT/RW Dengan Router Mikrotik Pada Komplek Srimas Plaju. *Bina Darma Conference on Computer Science*, 50–57.

Anisa, A., Fretty, G. W., Kamelia, P., Kurniawan, L., & Seil, H. K. (2023). Analisis Kualitas Layanan Jaringan Internet Indihome LAN. *Jurnal Ilmiah Multidisiplin Ilmu Komputer*, *1*(1), 24–30.

Bobanto, W. S., Lumenta, A. S. M., & X., N. (2014). Analisis Kualitas Layanan Jaringan Internet (Studi Kasus PT. Kawanua Internetindo Manado). *E-Journal Teknik Elektro Dan Komputer*, *4*(1), 80.

Cisco Networking Academy. (2024). *Networking Essentials: Wireless and LAN Fundamentals*. Cisco Press.

Cisco Systems. (2022). *Cisco Wireless LAN Design Guide for Enterprise Networks*. Cisco Press.

Doloksaribu, V. G. (2019). *Daya terima cookies dengan variasi penambahan formula tempe dan bayam hijau*.

Dunkel Schetter, C., & Tanner, L. (2021). Anxiety, depression and stress in pregnancy: Implications for mothers, children, research, and practice. *Current Opinion in Psychiatry*, *34*(2), 122–128. https://doi.org/10.1097/YCO.0000000000000675

Dwinanda, P. U. O. (2021). *Redesain Batalyon Zeni Tempur 4/TK di Ambarawa*. Universitas Katolik Soegijapranata.

ETSI TIPHON. (2021). *Quality of Service (QoS) Classes and Parameters for IP-based Networks*. ETSI.

Gartner Research. (2023). *Best Practices for Designing Secure and Scalable WLAN Infrastructure*.

Hariyadi, C. (2009). Graf Dalam Topologi Jaringan. *Ilmu Komputer Dan Teknologi Informasi*, *3*(2), 1–5.

IEEE. (2020). *IEEE Standard 802.11ax: High Efficiency Wireless LAN (Wi-Fi 6)*. IEEE Standards Association.

International Telecommunication Union. (2019). *Recommendation E.800: Definitions of Quality of Service Parameters*. ITU-T.

Jain, R. (2020). *Performance Analysis of Computer Networks and Systems: QoS, QoE, and Network Design*. Springer.

Kementerian Komunikasi dan Informatika Republik Indonesia. (2023). *Pedoman Pengembangan Infrastruktur Telekomunikasi dan Internet Nasional 2023–2027*. Kemenkominfo RI.

Kurose, J. F., & Ross, K. W. (2021). *Computer Networking: A Top-Down Approach* (8th ed.). Pearson.

National Institute of Standards and Technology. (2023). *Guidelines on Security of Wireless Local Area Networks (WLANs)*. U.S. Department of Commerce.

Nugraha, D., & Hidayat, R. (2020). Evaluasi Kinerja Jaringan Wi-Fi Menggunakan Parameter QoS di Lingkungan Kampus. *Jurnal Rekayasa Sistem Komputer*, *9*(3), 120–128.

Rahman, M. F., & Puspitasari, N. (2023). QoS Evaluation of Wi-Fi 6 Networks in Smart Office Environments. *International Journal of Computer Networking and Communications*, *15*(4), 88–99.

Sudarta. (2022). Analisis QoS dan RMA Jaringan WISP di Balai Bahasa Provinsi Sumatera Selatan. *Jurnal Teknologi Dan Komputer*, *16*(1), 1–23.

Suherman, D., & Widodo, A. (2020). Simulasi Perancangan Topologi WLAN Menggunakan Cisco Packet Tracer. *Jurnal Teknologi Dan Komputer*, *12*(2), 55–64.

World Bank. (2024). *Digital Infrastructure for Development: Policy Frameworks for Connectivity in Southeast Asia*. World Bank Publications.

Yusriadi, Y., & Suryadi, A. (2021). Analisis Optimalisasi Sinyal Wireless LAN di Kantor Pemerintah Kota Makassar. *Jurnal Teknologi Dan Informasi*, *6*(2), 98–108.