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Optimization of Access Point Placement on the Telkom Akses Wi-Fi Network Using NetSpot

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Abstract

The internet has become one of the most essential communication services that is widely utilized across all sectors of society. At the Telkom Akses Warehouse, Wi-Fi technology is used to provide internet connectivity for employees, technicians, and visitors. However, one of the major problems identified is that the placement of access points has been carried out solely based on immediate needs and the subjective preferences of installers, resulting in suboptimal signal distribution and unstable internet connectivity. This study aims to optimize the placement of access points on the Telkom Akses Wi-Fi network using the Action Research method and the NetSpot application as the primary analytical tool. Action Research was applied as a structured and controlled research approach to deliberately introduce changes in the network environment and monitor their impact. The results of signal level and coverage measurements indicate that the number and placement of access points required to adequately cover an area depend on the type and specifications of the access points used. After optimization, the measured signal levels reached −38 dBm to −40 dBm, which fall into the very good category. The findings further demonstrate that distance is not the only factor influencing the quality of the received signal. The physical structure of the warehouse, including walls, glass partitions, and other obstacles, also significantly affects Wi-Fi signal propagation and quality.

Keywords

Wi-Fi Network, Action Research, Access Point, NetSpot

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Introduction

The internet is one of the fastest-growing communication services and has become an indispensable infrastructure in almost every sector of human activity, including business, industry, education, and public services. Rapid and reliable internet access supports operational efficiency, accelerates information exchange, and enhances organizational productivity (Stallings, 2014; Kurose & Ross, 2017). In industrial and logistics environments, such as warehouse facilities, internet connectivity plays a crucial role in inventory management, data reporting, and coordination among employees (Tanenbaum & Wetherall, 2011). At the Telkom Akses Warehouse, Wi-Fi networks are utilized to support daily operational activities, allowing employees, technicians, and visitors to access network services anywhere within the coverage area.

From the standpoint of infrastructure development costs, wireless networks are generally more flexible and economical than wired networks, especially for large open areas such as warehouses (Sofana, 2013; Forouzan, 2013). Wi-Fi technology offers ease of installation, mobility, and scalability without extensive cable deployment. However, wireless networks also face inherent limitations, particularly related to signal attenuation, interference, and coverage instability (Lestari, 2019; Ryansyah & Irawan, 2023). At the Telkom Akses Warehouse, access points were originally installed based solely on immediate needs and installer discretion, without professional site surveying or signal analysis. As a result, Wi-Fi signal coverage is uneven, leading to unstable connectivity.

The physical characteristics of warehouse buildings also greatly influence Wi-Fi signal propagation. Construction materials such as reinforced concrete, metal racks, glass partitions, and long distances between access points significantly reduce signal strength (Rappaport, 2002; Firmansyah et al., 2021). Wi-Fi signal strength is typically measured in decibel milliwatts (dBm), where values closer to zero indicate stronger reception. Signal quality generally ranges from −10 dBm (very strong) to −99 dBm (very weak). According to commonly used Key Performance Indicator (KPI) standards, Wi-Fi signal quality is categorized as Excellent (≤ −80 dBm), Good (−90 to −80 dBm), Medium (−100 to −90 dBm), Poor (−110 to −100 dBm), and Very Poor (< −110 dBm) (Cisco Systems, 2020; Ekahau, 2019).

Poor access point placement results in dead zones, high packet loss, and reduced throughput, which directly degrade network performance and user experience (Padlillah & Suryadi, 2019; Afrianto & Yuliana, 2021). In operational environments such as warehouses, unstable Wi-Fi can disrupt barcode scanning, database access, logistics coordination, and real-time communication. Therefore, professional Wi-Fi performance evaluation and optimization are essential to ensure reliable and continuous service (Putra & Handayani, 2020; Septyani et al., 2024).

To analyze Wi-Fi performance accurately, professional software tools are required. One widely used application is NetSpot, a Wi-Fi site-survey and network analysis tool available on Windows, macOS, Android, and iOS platforms (NetSpot Team, 2022). NetSpot supports heatmap visualization, signal strength measurement, channel interference detection, and noise level analysis. Utilizing NetSpot allows network administrators to identify coverage problems,

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overlapping channels, and interference sources, thereby supporting optimal access point placement (Budiman & Suharyanto, 2021; Hadi et al., 2022).

Based on these issues, this research is conducted under the title "Optimization of Access Point Placement on the Telkom Akses Wi-Fi Network Using NetSpot." The main research problem addressed is how to optimally place access points at the Telkom Akses 3 Ilir Warehouse to improve overall Wi-Fi network performance. The objectives of this study are: (1) to determine optimal access point placement, (2) to improve Wi-Fi network coverage and stability, and (3) to evaluate Wi-Fi signal quality based on standardized parameters. It is expected that the results of this study will serve as a technical reference for wireless network optimization in industrial warehouse environments.

Methodology

Research Method

This study employed the Action Research method. Action Research is a systematic and participatory research approach aimed at finding effective ways to deliberately introduce changes within a controlled environment and evaluate their outcomes. The main objective of Action Research is to improve real-world practices through cycles of planning, action, observation, and reflection.

Figure 1. Metode Action Research

The data collection techniques used in this study included:

1. Literature Study – A comprehensive review of books, scientific journals, and online sources related to optimization, access point placement, Wi-Fi networks, Received Signal Strength Indicator (RSSI), Microsoft Visio, InSSIDer, and NetSpot.
2. Direct Observation – On-site observation of the existing Wi-Fi network conditions at the Telkom Akses Warehouse.
3. Interviews – Direct interviews with warehouse personnel, particularly the Inventory and Asset Management staff, to obtain detailed information regarding current network issues.
4. Case Study – In-depth signal analysis and access point placement evaluation within the warehouse area.

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Action Research Stages

The Action Research stages applied in this study consisted of the following steps:

1. Diagnosing
   Identification of the main problems in the existing Wi-Fi network at the Telkom Akses Warehouse, particularly related to uneven access point coverage and weak signal distribution.
2. Action Planning
   Development of a structured plan for optimizing access point placement based on initial diagnosis and site analysis.
3. Action Taking
   Implementation of the planned optimization by adjusting and repositioning access points based on NetSpot simulation results, followed by field measurements.
4. Evaluating
   Evaluation of network performance after optimization based on signal level, Signal to Interference Ratio (SIR), and coverage area using NetSpot and InSSIDer applications.LearningReflection on implementation results and formulation of conclusions based on performance improvements.

Initial Access Point Placement

Prior to optimization, the existing network topology showed that Wi-Fi signal coverage was uneven, and several areas within the warehouse were not adequately covered by the existing access points. This condition resulted in multiple dead zones with poor connectivity.

Results

Warehouse Layout Design

Before conducting measurements and observations, a detailed warehouse layout was prepared using Microsoft Office Visio 2010. This layout served as the basis for simulation and optimization planning. The resulting layout depicts all warehouse spaces, corridors, partitions, and access point positions.

Measurement and Observation Points

Test points were evenly distributed throughout the warehouse area to facilitate systematic signal measurements. In each room, three measurement points were selected to ensure representative data collection. Along the warehouse corridors, test points were set at constant intervals.

Signal Level and Signal to Interference Ratio (SIR) Optimization

Signal level and SIR measurements were conducted to evaluate interference and signal degradation. These parameters were used to determine whether co-channel interference or physical obstacles were affecting network quality. Measurements were displayed in the form of NetSpot heat maps and compared with standardized signal quality thresholds.

The analysis identified several external Wi-Fi SSIDs originating from nearby buildings that interfered with the warehouse network. These external networks reduced the performance of the internal access points due to overlapping channels.

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Signal Distance Measurement (RSSI)

After optimization, RSSI measurements were conducted using the InSSIDer application. Several test phases were carried out as follows:

1. First Test
   Average RSSI value: −44 dBmAccess point height: 3.5 metersDistance: 8 meters
2. Second Test
   Average RSSI value: −48 dBmThe receiver distance was closer than in the first test.
3. Third Test
   Average RSSI value: −50 dBmThis test involved a greater distance and physical obstacles between the transmitter and receiver.
4. Fourth Test
   Average RSSI value: −40 dBm, measured several weeks after the previous tests.

These results indicate strong and stable signal strength after optimization.

Discussion

The results of this study demonstrate that the optimization of access point placement using NetSpot significantly improved Wi-Fi signal coverage and overall network quality within the Telkom Akses Warehouse. Prior to optimization, several areas experienced weak signal strength categorized as poor to very poor based on dBm measurements. After repositioning the access points according to the heatmap and signal distribution generated by NetSpot, these dead zones were successfully eliminated. The post-optimization measurements show that most areas now fall into the good to excellent signal quality category, indicating a substantial improvement in network performance.

The findings also confirm that physical obstacles such as concrete walls, glass partitions, and storage racks significantly affect signal attenuation. Even when the distance between access points and client devices was relatively short, signal degradation still occurred due to these obstructions. This aligns with Wi-Fi propagation theory, which states that electromagnetic waves experience reflection, diffraction, and absorption when passing through solid materials. Therefore, access point placement cannot rely solely on distance calculations but must also carefully consider the building layout and structural barriers.

In addition to physical obstacles, channel overlap among access points was identified as a major source of interference that previously reduced network performance. Several access points initially operated on overlapping frequency channels within the same coverage area, causing co-channel interference and degradation in throughput. After conducting channel reallocation based on NetSpot interference analysis, the access points were distributed across non-overlapping channels. This channel planning strategy effectively reduced interference and improved network stability and data transmission consistency.

Furthermore, the optimization process resulted in a more even distribution of signal strength throughout the warehouse. Before optimization, certain areas received excessive signal strength while others suffered from weak reception. Such imbalance can lead to inefficient roaming behavior in client devices and unstable connectivity. After optimization, the signal distribution became more uniform, allowing client devices to switch between access points more smoothly without experiencing frequent disconnections or packet loss.

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From an operational perspective, the improved Wi-Fi performance has a direct positive impact on the productivity of Telkom Akses Warehouse employees. Faster data access, reduced latency, and stable connectivity support real-time inventory management, coordination between technicians, and online reporting activities. A reliable wireless network is especially critical in warehouse environments where mobility and rapid access to digital systems are essential for daily operations.

Overall, this study confirms that access point placement optimization using NetSpot is an effective and practical approach for improving Wi-Fi network quality in complex indoor environments such as warehouses. By integrating signal strength analysis, obstacle evaluation, and channel planning, the optimization process produces measurable improvements in coverage, stability, and performance. These results emphasize the importance of professional network planning rather than ad hoc access point installation, and they provide a strong foundation for future network expansion and performance evaluation at Telkom Akses.

Conclusion and Recommendations

Based on the results of this research, the following conclusions can be drawn:

1. The use of the NetSpot application proved highly effective as a reference tool for access point placement planning and Wi-Fi network optimization at the Telkom Akses 3 Ilir Warehouse.
2. Physical obstacles such as walls and glass significantly weakened signal propagation in certain areas.
3. The optimized access point layout successfully expanded the Wi-Fi coverage area and reduced zones with poor signal quality.
4. Access point placement directly affected coverage quality, and improper channel allocation caused channel overlap and interference.
5. The strongest signal was received by users located closest to the access point. After optimization, the minimum RSSI value obtained was −38 dBm, classified as very good, while the weakest recorded signal was −67 dBm, still classified as good.

Overall, the optimization successfully improved Wi-Fi performance and ensured more reliable network connectivity throughout the warehouse.

Disclosure Statement

The authors declare no conflict of interest related to this study.

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Biographical Notes

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