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Research Article

Design of a Wireless Fidelity Network Using the Open Shortest Path First Protocol in the Computer and Network Engineering Research Room at Politeknik Negeri Jakarta

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ABSTRACT

The rapid advancement of information and communication technology has driven educational institutions to optimize their technological infrastructure to support academic and research activities. One crucial element in education, particularly in the Computer Engineering and Networking Research Room at Politeknik Negeri Jakarta, is the availability of reliable internet connectivity. Wireless technology, such as Wi-Fi, provides a flexible and easily accessible solution. However, its effectiveness depends significantly on proper design and the implementation of appropriate routing protocols to ensure optimal performance. In the field of computer networking, routing protocols play a vital role in determining the most efficient route for data transmission. The Open Shortest Path First (OSPF) protocol is widely recognized for its ability to select the optimal path based on metrics such as path cost and speed. By implementing OSPF, Wi-Fi network management can become more efficient, ensuring stable and reliable data transmission even in complex network traffic scenarios. This study aims to design a Wi-Fi network utilizing the OSPF protocol in the Computer Engineering and Networking Research Room at Politeknik Negeri Jakarta. The anticipated outcome is a network that not only meets the research requirements but also serves as a model for adoption by other educational institutions.

Keywords: OSPF; Wi-Fi; Network Design; Research Room; Routing Protocol; NDLC

1. INTRODUCTION

The development of information and communication technology has encouraged educational institutions to maximize the use of technological infrastructure in supporting academic and research activities (Danuasmo, Nazuarsyah, & Ginting, 2023). One of the important elements in the world of education, in this case specifically the availability of internet networks, especially in the Computer and Network Engineering research room at the Jakarta State Polytechnic. Wireless technologies such as Wireless Fidelity (Wi-Fi) become a flexible and easily accessible solution, but their success greatly depends on good design and the use of appropriate routing protocols to ensure optimal performance. In the world of computer networks, routing protocols play an essential role in determining the best route for data transmission. Open Shortest Path First (OSPF) is one of the widely used dynamic routing protocols due to its ability to select optimal paths based on certain metrics such as path cost and speed (Utami, Jati, & Setianingsih, 2017). By implementing OSPF, Wi-Fi network management can be conducted more efficiently, ensuring a stable and reliable data flow even under complex network traffic conditions (Bramantya, 2015; Mutoffar et al., 2024).

Although the OSPF protocol has various advantages, its implementation in environments such as Computer and Network Engineering research labs presents various challenges. Using a packet tracer can save time in designing topologies (ALLISYA, 2022). Some of these include accurate hardware and software configuration as well as adequate data traffic management. Therefore, comprehensive planning and implementation are necessary to ensure that the resulting network can optimally meet the research needs.This research aims to design a Wi-Fi network based on the OSPF protocol in the Computer Engineering and Networking research room at the Jakarta State Polytechnic. With this design, it is expected that the resulting network will not only support research needs but also serve as a reference for the application of network technology that can be adopted by other educational institutions (SIBURIAN, 2020; Sutanta & Lestari, 2019).

2. RESEARCH METHOD

This research uses the Network Development Life Cycle (NDLC), which is a methodology used to design, build, and manage computer network systems. NDLC prioritizes a structured approach in the network development process, taking

into account each interconnected stage. The main objective of NDLC is to ensure that network development is carried out by analyzing needs up to the monitoring stage, so that this design can meet user requirements.Detailed explanations for each stage can be seen according to the **Figure 1**.

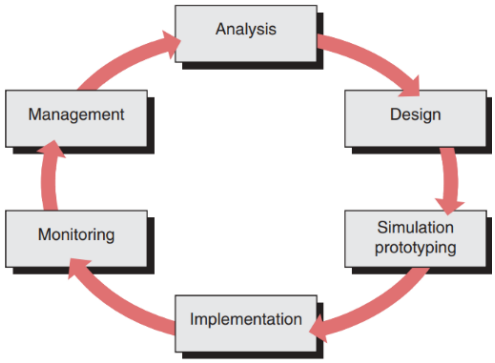


Figure 1. Stages of the research method

Analysis At this stage, a study is conducted on network needs, identification of issues such as connection disruptions and an increase in the number of users, as well as determining solutions to create a better network. Network design includes creating a new topology using OSPF, selecting appropriate hardware, configuring IP settings, and setting up data paths to ensure a more optimal flow of information.

Prototype

This stage tests the network prototype through simulation to observe the design performance, identify potential issues, and evaluate the effectiveness of OSPF in managing efficient data routes.

Implementation

At the implementation stage, the hardware is installed and configured according to the design that has been created. The Wi-Fi network is built, the OSPF protocol is implemented, and the network operates according to the predetermined plan. Monitoring Monitoring is conducted continuously to ensure the network operates stably, to monitor data flow, and to resolve issues related to connectivity or network capacity that may arise. The management phase aims to maintain the network by managing hardware, updating configurations, and continuously optimizing network performance in line with evolving needs.

3. RESULTS AND DISCUSSION

The results of the analysis conducted can be identified in the network needs planning for the Computer Engineering and Networking Research Room. Requires 2 Cisco 1941 routers, a Cisco 2960 switch, 2 Wi-Fi routers, 2 personal computers, and 2 laptops. In this design, there are 2 access points that will be installed to ensure the entire research room area is well-covered by the Wi-Fi signal. The use of OSPF allows data paths to be dynamically managed, optimizing bandwidth utilization, and maintaining service quality under various data traffic conditions.

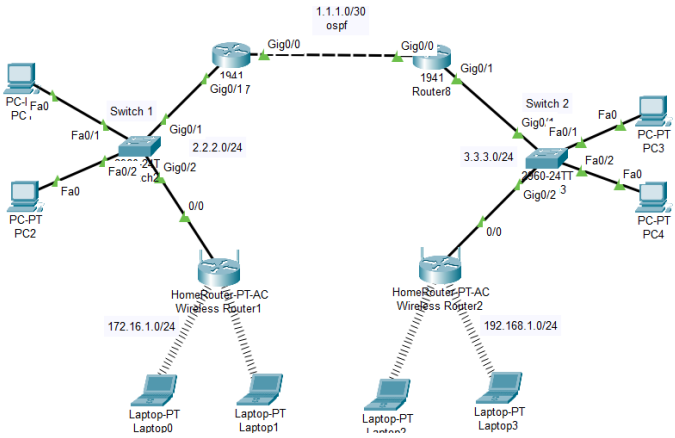


Figure 1. Network Topology

The network prototype is tested through simulation to demonstrate the connection between computers and the access point before being implemented in reality. The simulation was conducted by depicting the network conditions that would be encountered using OSPF.

Figure 2. SSID Configuration

At the implementation stage, the network designed in the prototype stage can be applied in the Computer Engineering and Networking Research Room at the Jakarta State Polytechnic. Hardware, such as routers and access points, are installed according to the design that has been created. Monitoring is conducted continuously to monitor network performance after implementation. The use of network management software allows for monitoring data traffic and detecting any disruptions or declines in network performance.

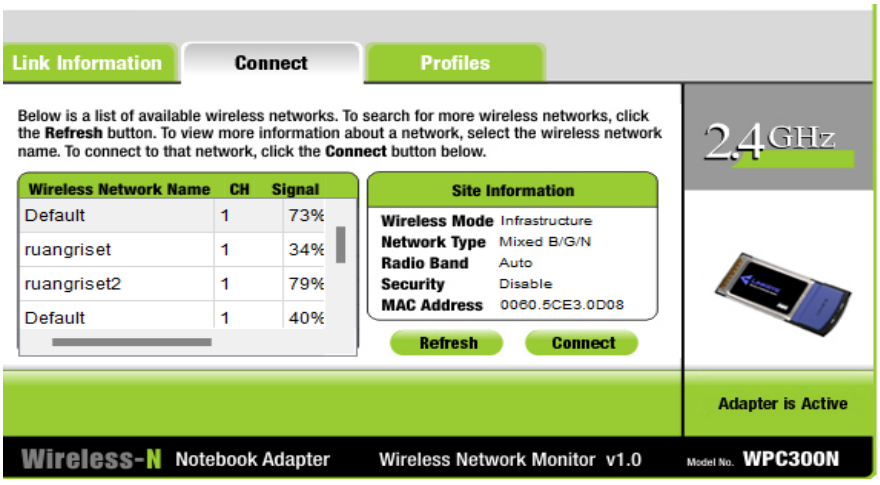
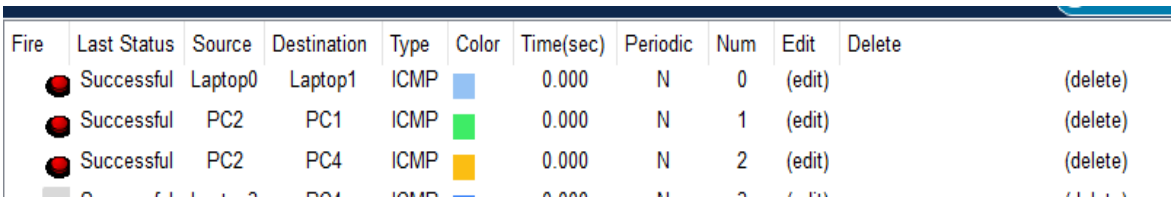


Figure 3. Connection to wifi

At the management stage, network maintenance and management are carried out periodically. Hardware and software updates are carried out to improve performance and address emerging issues.



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Laptop0	Laptop1	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC2	PC1	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC2	PC4	ICMP		0.000	N	2	(edit)	(delete)

Figure 4. Connection between PCs

4. CONCLUSION

This research successfully designed and implemented a Wi-Fi network using the Open Shortest Path First (OSPF) protocol in the Computer Engineering and Networking Research Room at the State Polytechnic of Jakarta to address issues of unstable connectivity and high traffic load. Future research can be directed towards enhancing security by adding protocols such as IPsec or SSL to protect data during tunneling and port forwarding processes. Additionally, a more comprehensive evaluation of network performance, including aspects such as latency, throughput, and packet loss, can be conducted to assess the reliability of the solution under various traffic conditions. Research can also focus on the integration of VPN with the latest technologies, such as cloud computing or software-defined networking (SDN), as well as comparing the performance of OSPF with other routing protocols, such as BGP or EIGRP, and using IPv6.

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