

# Design and Implementation of A Wireless Local Area Network (WLAN) Using A Combination of Access Point and Wireless Internet Service Provider (WISP) Mode for A University Network

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**Abstract**— In the era of digitalization today technology development continues to advance rapidly in the world as well as in Timor-Leste although too late but continue to adapt to the use of technologies and continue to develop according to the conditions of Timor-Leste, technology helps our people's work becomes faster and easier. The objective of this project is that the author can have the imagination to design and simulate the network technology that is implemented at the University. This project design uses the NDLC (Network Development Life Cycle) method with several stages such as: Analysis, Design, Simulation Prototyping, Implementation and Monitoring. After the project is completed, the network at the University can reach Finance, Rectorate, Post-Graduation and the Faculty of Law. Thus, with the WLAN network in the University can perform better and faster. The results of QoS WLAN show that Throughput value of 1.426, Packet Los value of 0%, Delay value of 21.3 ms, Jitter value of 3.0 ms.

**Keyword:** Network, Access Point, WISP, QoS, WLAN

## I. INTRODUCTION

The Internet (Interconnected Network) consists of many computers connected to each other. The connection medium can also be a telephone line, fiber optic cable, satellite, or wireless connection. Wi-Fi (Wireless Fidelity) is a wireless technology that connects electronic devices to the internet or other networks without cables[1]. Among wireless networks, one of the most widely used and common is the Wireless Local Area Network (WLAN), which can be defined as a type of wireless network. Wi-Fi not only provides access to personal internet but also access to other important sectors such as education, healthcare, industry, government, business, and others[2].

The University of Dili is a private institution located at Av.

President Nicolao Lobato Mascarenhas Dili, Timor-Leste. The University of Dili has Faculties, Directorates, Administration, Rectorate, and other facilities to provide administrative and academic services to students. The University of Dili also has an intranet network to facilitate the work of the directorates. However, among the existing directorates, the intranet network has not been properly implemented, a problem that presents significant challenges for each directorate. According to the researchers' initial assessment, the Directorate of Finance, the Rectorate, the Postgraduate Program, and the Faculty of Law do not yet have an intranet connection and require one. The reason for the lack of an intranet connection is that the topology of each building makes wired connections very difficult. Therefore, the researchers identified and defined an intranet network connection using a point-to-point model, combining wireless and wired models using an Access Point and a Wireless Internet Service Provider (WISP)[3].

WISP mode on a wireless router allows the router to act as a wireless client, then share that internet connection with other devices. Access Point mode on a wireless router is a setting that converts the router into a wireless access point, allowing other devices to connect to the internet via Wi-Fi without the router acting as the primary router. Access Point mode does not have routing functions such as a DHCP server or firewall like a standard router, but provides wireless access to the network. The solution to the above problem is to design a combination of Access Point and WISP connections to provide a good internet network for the Directorate of Finance, Rectorate, Postgraduate, and Faculty of Law to provide good services for academic and administrative services. Another fundamental reason for using a combination of Access Point and WISP is to reduce cabling costs and flexibility for new network connections if available.

**II. RESEARCH METHOD**

The research model used by the researcher to conduct this monograph is a qualitative model. A qualitative model is a research model in the humanities, involving discipline-based activities to collect, explain, analyze, and interpret facts and relationships between natural phenomena, society, and human behavior to gain new knowledge[4].

The researcher used this qualitative research model because it relates to issues occurring at the University of Dili, specifically in the Directorate of Finance, the Rectorate, the Postgraduate Program, and the Faculty of Law. These lack an intranet network connection, necessitating the researcher to conduct the research using an interview model because it does not collect data using numbers[3].

The researcher will conduct the research at the University of Dili, specifically in the Directorate of Finance, the Rectorate, the Postgraduate Program, and the Faculty of Law. The duration of the research and network implementation it will be approximately four weeks.

The research method used by the researcher is the Network Development Life Cycle (NDLC), a method for developing or designing network infrastructure, with the network monitored to determine statistical values and network performance[5].

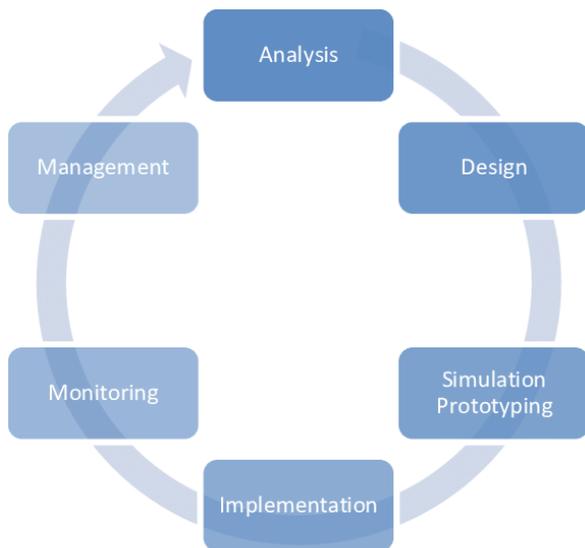


Fig. 1. Network Development Life Cycle.

**III. RESULT**

The current network system doesn't yet reach the Finance, Rectorate, Postgraduate, and Faculty of Law departments. If the existing network system already covers the Finance, Rectorate, Postgraduate, and Faculty of Law departments, researchers would only need to add a few missing elements. Therefore, the researchers decided to design a WLAN network system to be implemented at the research site.

Researchers have conducted research and the network system currently running at the University of Dili, namely the

Intranet network, has not yet reached the Department of Finance, Rectorate, Postgraduate, and Faculty of Law with the following topology:

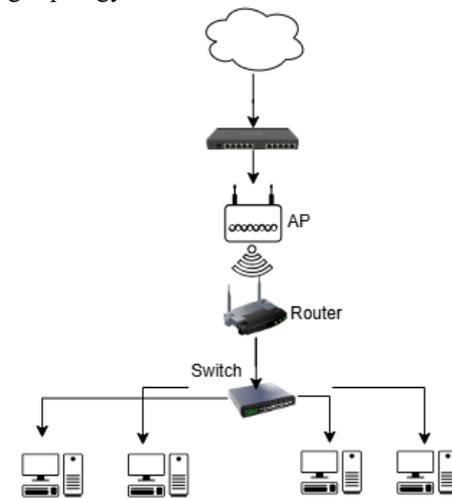


Fig. 2. Actual Topology of the Research Site.

In this step, the researcher will design a recommended network topology for implementation at the research site. Therefore, with the newly designed topology, the researcher hopes to address the following issues faced at the research site:

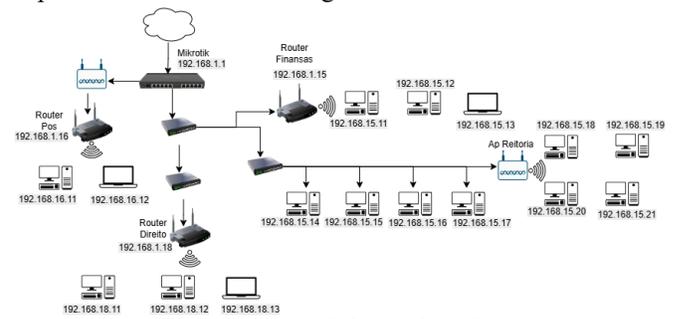


Fig. 3. Recommended network topology.

The network topology that will be implemented by researchers in the fields of Finance, Rectorate, Postgraduate, and Faculty of Law uses a tree topology model. Researchers use an outdoor router that functions as an access point to provide internet from the server to two (2) WISPs that will be installed in the Postgraduate School and Faculty of Law to share the internet network with customers.

In this section, the researcher makes an IP address allocation for each client in the network system that has been identified in the previous stage, namely as follows:

Table 1.  
IP ADDRESS ALLOCATION

Name	Subnet	Default Gateway	IP Range
Finance & Rectorate	192.168.15.1 /24	192.168.1.1	192.168.15.10 - 192.168.15.50
Postgraduate	192.168.16.1 /24		192.168.16.10 - 192.168.16.20
Faculty of Law	192.168.18.1 /24		192.168.18.10 - 192.168.18.30

System testing is the final step to determine and ensure that the implemented WLAN network runs smoothly and ensures that users who use the network do not experience network or user failures[6]. Therefore, system testing is determined by the quality of the WLAN network implemented in the Directorate of Finance, the Rectorate, the Postgraduate Program, and the Faculty of Law itself. From the network, a QoS table will also be viewed so that further information can be obtained and ensure the network itself through the QoS (Quality of Service) table[7].

Table 2.  
RESULTS OF QOS (QUALITY OF SERVICE)

Router / Provider	QoS parameters	Value	Index	Categories
Finance & Rectorate	Throughput	2609K	4	Very Good
	Packet Loss	0%	4	Very Good
	Delay	3.3ms	4	Very Good
	Jitter	0.1ms	3	Good
Postgraduate	Throughput	1559K	4	Very Good
	Packet Loss	0%	4	Very Good
	Delay	4.6ms	4	Very Good
	Jitter	6.7ms	3	Good
Faculty of Law	Throughput	111K	4	Very Good
	Packet Loss	0%	4	Very Good
	Delay	56.2ms	3	Good
	Jitter	2.4ms	3	Good

**IV. CONCLUSION**

In conclusion, researchers have analyzed, designed, and implemented a WLAN network to improve the quality of connectivity and efficiency of wireless networks. This research was conducted at the University of Dili, specifically in areas with high user density and significant internet access needs. Researchers used routers, switches, access points, laptops, and applications such as Draw.io and Wireshark. The results of this study indicate that the designed WLAN network has the capacity to provide stable connectivity and the channel configuration has been shown to increase signal range and reduce interference between devices. The average WLAN QoS results at the implemented research site showed a Throughput value of 1,426, a Packet Loss value of 0%, a Delay value of 21.3 ms, and a Jitter value of 3.0 ms.

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