

# Recommendation to Improve Wireless LAN Controller (WLC) Device Performance Using DMAIC Method

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## Abstract

PT. XYZ has collaborated with PT. Telkom Indonesia (Persero), Tbk to maintain and manage the WLC Autelan devices as one of the backend devices needed to provide wifi.id services. However, during the last 6 months of 2021, Autelan WLC devices have experienced a slight decrease in performance with frequent problems with the device. Data analysis was carried out using the DMAIC method and initial findings showed that from the Pareto diagram it was found that the largest percentage of the type of problem was service restore with a cumulative percentage of 60%. Then a fishbone diagram was carried out to find out the factors causing the WLC Autelan equipment to experience a decrease in performance quality assisted by FGD activities. It was found that there were 4 main factors, namely measurement, milieu, method, machine. Furthermore, the proposed improvement is carried out using the 5W1H method. Some suggestions for improvement include making a monitoring dashboard for all managed devices, changing the WLC devices system to active-backup, carrying out preventive maintenance activities twice a year, and moving devices from a room with a stable room temperature so that the device does not overheat.

**Keywords:** WLC Devices, DMAIC Method, 5W1H Tools, Fishbone Diagram

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## Introduction

Technological advances are very fast and the spread of Internet connections that are very widely spread make people's demand for fast and reliable Internet connections increase. The need for Internet connection in Indonesia is increasing from year to year. Derived from APJII sources, Indonesia's internet usage continues to increase from year to year and it is estimated that as many as 196.7 million users in 2020 (Asosiasi Penyelenggara Jasa Internet Indonesia, 2020). The use of Internet technology services can be reached by the community, one of which is a wireless network. Wireless network (WLAN) is a network that is governed by frequency signals, with network access without a cable connection that allows high user mobility and flexibility in certain domains (range) (Nazir et al., 2021). IEEE 802.11 is a standard used by wireless networks using the license-free spectrum of 2.4GHz and 5GHz bands (Song & Issac, 2014). WLANs usually consist of multiple access points (APs), where mobile nodes are connected to the global internet via a Wi-Fi interface (Zhu et al., 2017).

Wi-Fi can be accessed via private or public. Currently, there is an increase in the spread of public wireless access points that can be accessed by portable computing devices such as tablets and smartphones that making it easier for people to access information on the Internet publicly (Cheng et al., 2013). wifi.id is one of the internet services based on Wi-Fi technology developed by PT. Telkom Indonesia which can be used as a medium to enjoy high-speed internet services that can be accessed in public places throughout Indonesia (Nareswari & T, 2016). Many Access Point (AP) installed by PT. Telkom Indonesia in several corners of public places such as shopping centers, parks, and others in order to serve wifi.id services that can be used in public places. In a WLAN with a larger number of APs, it will be a challenge to manage and configure the APs, so a Wireless LAN Controller (WLC) is needed (Zhu et al., 2017). PT. Telkom Indonesia uses several WLC platforms that are used to manage APs to provide wifi.id services, one of which is using the Autelan platform.

Maintenance of wifi.id backend devices by PT. Telkom Indonesia is an absolute thing that must be done, one of which is the WLC Autelan. However, PT. Telkom Indonesia has limited competence and internal resources, therefore support from external resources is very much needed, especially to deal with things that have not or can't be done by PT. Telkom Indonesia itself. Cooperation support from external resources in question, namely from vendors or if needed from proprietary principals. Most IT companies that involve a fairly high intensity of IT services use vendor services to help manage the products produced by the company by being bound by a contract that has been agreed by both parties (Chang & Gurbaxani, 2019). Therefore, PT. Telkom Indonesia appointed PT.XYZ as a vendor to maintain and manage the WLC device Autelan because of PT.XYZ is the only company that cooperates with Autelan's principal. Maintenance is an activity that is carried out repeatedly with the aim of keeping the device in a condition that is acceptable to the user or can work according to its function (Nawang Sari & Sutawijaya, 2019).

However, during the last 6 months of 2021 performance of the WLC Autelan device slightly decreased with hardware failure, a self-restart of WLC device, etc. Details of each problem that occurs can be seen in Figure 1.

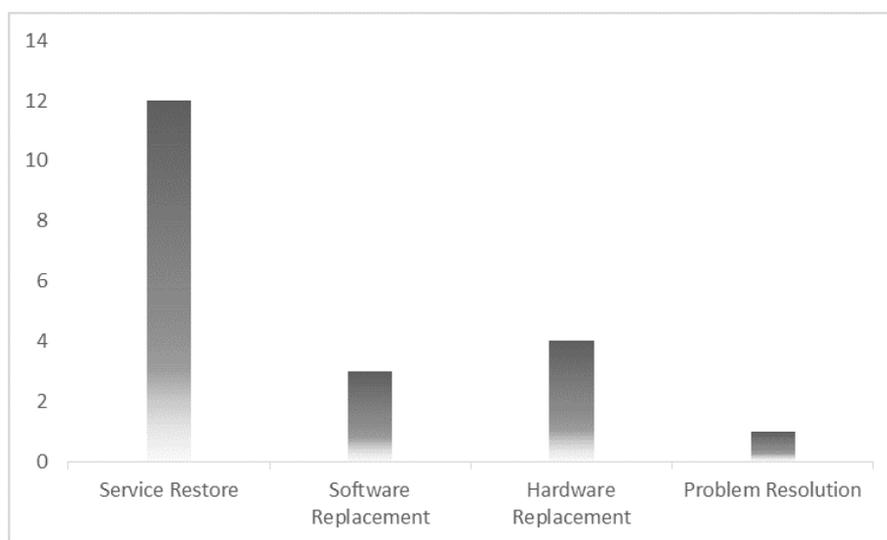


Figure 1. Problem Details of WLC Autelan Devices

From figure 1 it can be seen that the WLC Autelan devices often experiences interference. Therefore, it is necessary to evaluate the performance of the device and improve it to improve the quality of the device. To get the repair process on the WLC Autelan devices correctly, the author uses the DMAIC method. The DMAIC (Define, Measure, Analyze, Improve & Control) method is a method for defining problems, measuring problem levels, analysing, and making improvements as needed (Kurniawan & Nugroho, 2021).

## Literature Review

### Wireless LAN Controller (WLC)

Wireless Controller (WLC) is a device that acts as a mastermind for wireless networks by providing and managing access points and Service Set Identifiers (SSID) as well as routers for authentication requests to Remote Authentication Dial-In User Service (RADIUS) servers (Jaakonsaari, 2019). For a very large wireless network topology, WLC is needed for wireless network clustering with WLC operation using an active backup system that aims to provide load balancing services for distributed access points and DNS gateways (Niranjan & Kenchaiah, 2020).

## DMAIC Method

DMAIC (Define, Measure, Analyze, Improve, Control) is one of the most widely used methods to guide practitioners in the decision-making process of quality improvement projects (Rahayu & Santoso, 2021). DMAIC methods are commonly used for quality improvement used to eliminate defects from products, services, and processes (Sastri & Lakshmi Narayana, 2019). The explanation of each phase in the DMAIC method is as follows (Karakhan, 2017):

1. **Define phase:** define phase consists of identifying the process and defining the scope of the problem, basically it involves identifying the inputs and outputs of a process.
2. **Measure phase:** measure phase is to assess performance and collect relevant data to answer questions about what and how problem occurs, the first step is to determine the frequency and accuracy, which helps determine the effect of the problem.
3. **Analyze phase:** data obtained during the previous stage were analyzed to determine the causal relationship to identify the root cause of the main event.
4. **Improve phase:** based on the information gathered and the analysis carried out during the first three phases, corrective and preventive actions have the potential to be considered during the improve phase.
5. **Control phase:** control phase includes verification, monitoring, and maintenance of the product or service to be improved.

## 5W1H Tool

5W + 1H is a tool that has the ability to analyze problems systematically and comprehensively in overcoming specific problems that need to be solved, besides that it can also be used to determine in designing new techniques or approaches to improve the capabilities of existing system (Imaroh & Soleh, 2020). Questions in 5W1H need to be formulated depending on the problems found during the conduct of the research (Parmar & Awasthi, 2018). 5W1H is a structured format to reveal context information by asking questions such as who, when, where, what, why, and how.

## Fishbone Diagram

Fishbone diagram is one of the methods/tools in improving the quality of a product or service (Neyestani, 2017). This tool is effective for systematically generating ideas about the causes of problems and presenting them in a structured form (Yusoff et al., 2019). The general category of fishbone diagrams usually consists of six elements (cause) such as milieu, material, machine, measurement, man, and method (Krupitzer et al., 2014).

## Methodology

This research uses descriptive quantitative research methods. Descriptive quantitative research is data obtained from a sample of the research population which is analyzed according to the statistical method used (Sugiyono, 2017). In this study, the population consisted of employees of PT. Telkom Indonesia and PT. XYZ is involved in the maintenance of the WLC Autelan devices. While the sampling technique used is nonprobability sampling with the technique taken is saturated sampling because the population is small, namely 5 employees with details 2 from PT. Telkom Indonesia and 3 from PT. XYZ. The entire sample population will be involved as informants in a group discussion forum (FGD) so that the information data

obtained can be used as a reference in the process of improving service performance on the WLC Autelan devices. Meanwhile, for data analysis using DMAIC Method as a process flow consisting of define, measure, analyze, improve, control. The stages of the research can be seen in the flowchart in Figure 2.

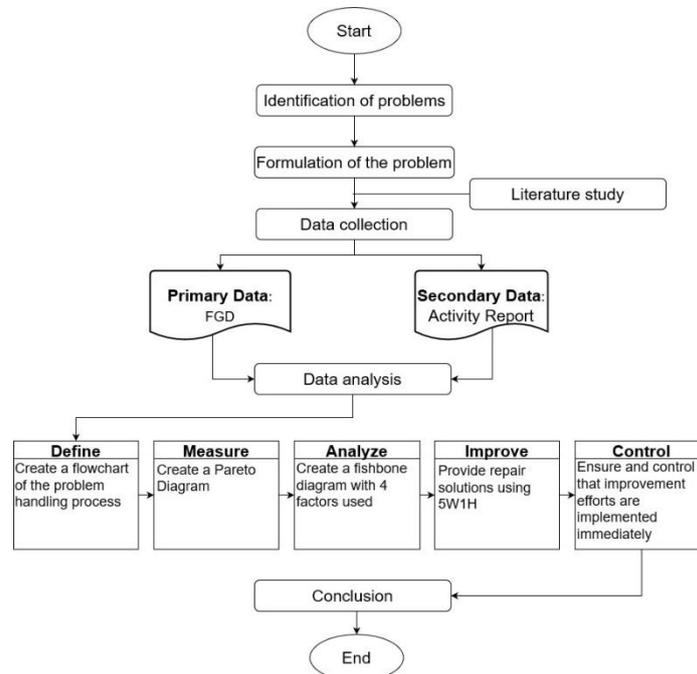


Figure 2. Flowchart of Research Stages

## Analysis and Results

The analysis in this study uses the DMAIC method. Researchers conducted an analysis during the last 6 months of 2021 on maintenance support service projects for WLC Autelan devices.

### Define Phase

This stage is the first stage that will be carried out in the DMAIC method to improve the performance of the WLC Autelan devices. Starting from how the engineer has been doing the process of problem handling. The tool used to show the process of handling this problem is by using a flowchart. From this stage, it will be known how the flow of the problem handling process is currently being carried out so that it will help a little to show whether there are obstacles/difficulties for the engineer in resolving the problem. Problem handling flowchart can be seen in figure 3.

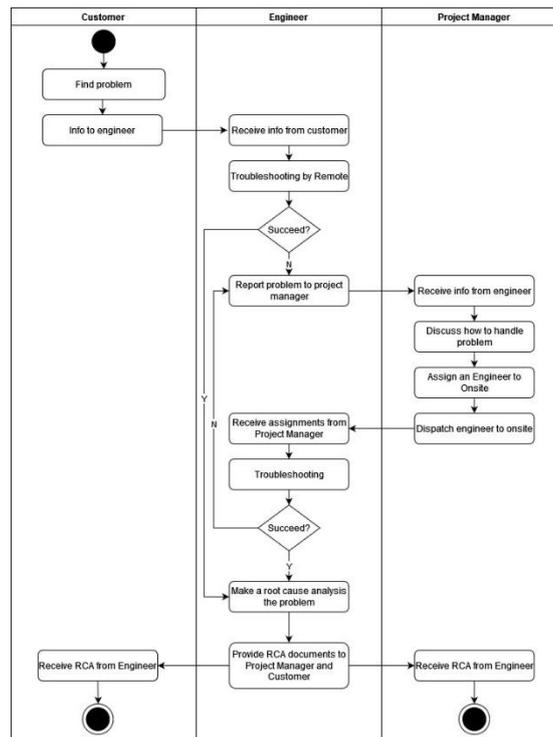


Figure 3. Flowchart Escalation Level of Problem Handling

In Figure 3 it can be seen that the problem is only troubleshoot by the engineer if the customer has informed that a disturbance has occurred. From the flowchart, it can be seen that there is no special monitoring system that can detect in real time if the WLC Autelan devices is experiencing problems.

**Measure Phase**

The measuring stage in the DMAIC method aims to validate the problem, collect the data needed for analysis, and measure the problem from the existing data. This data will produce useful information for researchers and management of PT. XYZ as knowledge to improve the performance of the Autelan WLC device. Things that will be done at the measure stage include making pareto diagrams. The pareto chart can be used to prioritize the types of problems that will be solved by looking at the number of incoming interruption order requests. The data used is from a resume of the number of incoming disturbance orders for during the last 6 months of 2021 with a pareto chart graph can be seen in Figure 4.

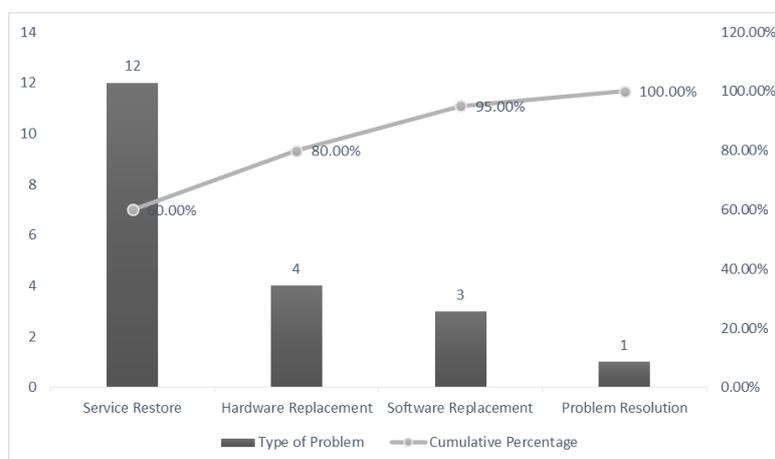


Figure 4. Pareto Diagram Based on the Type of Problem

Based on the pareto diagram in Figure 4, it can be seen that the most common type of problem for WLC Autelan devices is service restore.

**Analyze Phase**

In the analyze stage, what needs to be done is to analyze why the performance quality of the WLC Autelan devices for the last 6 months has decreased. The step that will be taken at the Analyze stage is to make a fishbone diagram. The method used to make fishbone diagrams is a brainstorming system or FGD (Focus Group Discussion) with parties related to the maintenance of the WLC Autelan equipment, namely 2 people from PT. Telkom Indonesia and 3 people from PT. XYZ. From the results of brainstorming and FGD, it was found that 4 factors that became problems in the quality of the performance of the WLC Autelan devices during the last 6 months had decreased, including machine, milieu, method and measurement. The fishbone diagram for this research can be seen in Figure 5.

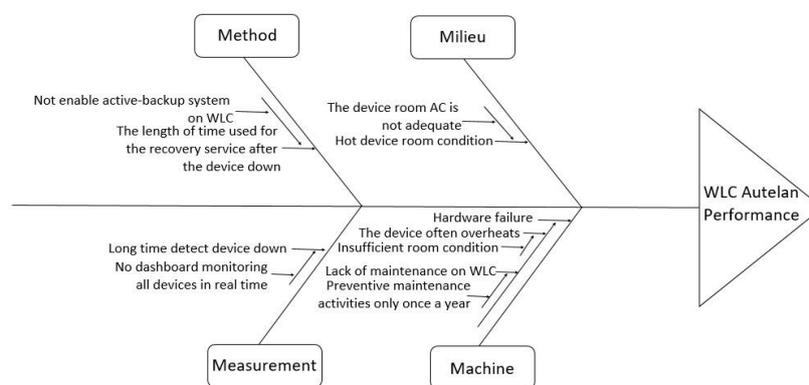


Figure 5. Fishbone Diagram for the Problem of WLC Autelan Performance

**Improve Phase**

At this stage is to determine the proposed improvement of the root causes that have been carried out at the analyze stage by conducting brainstorming or FGD (Focus Group Discussion) using a fishbone diagram. Improvement plans are carried out on all sources that make the performance quality of WLC Autelan devices decrease based on the results of fishbone diagram analysis. The method used to propose improvements is to use the 5W1H method. The following is a 5W1H table that contains plans and corrective actions for each cause.

Table 1. Recommend WLC Autelan Performance Improvement with 5W1H

Problem	WHY	WHAT	WHERE	WHO	WHEN	HOW
Hardware Failure	To avoid frequent failures on WLC	Maintain room temperature and preventive maintenance on devices	All managed devices	During maintenance	Project Manager, Engineer, Customer	Moving WLC equipment from the old room to a new room with stable temperatures, and changing preventive maintenance to 2X in a year
Long time detect device down	To find out more quickly if there is problem with the device	Monitor traffic in realtime	All managed devices	During maintenance	Project Manager, Engineer	Making device monitoring applications in real-time

Recovery service is very long	In order to speed up recovery service	Active backup system on WLC	All managed devices	During maintenance	Project Manager, Engineer, Customer	Enabling WLC configuration to active backup
Hot device room conditions	So that the device is not damaged/often overheats	Maintain room conditions at a stable temperature so that the device doesn't overheat	All managed devices	During maintenance	Project Manager, Engineer, Customer	Moving the WLC device from the old device room to a new device room with a more stable room temperature

### Control Phase

After compiling the improve stages using the 5W1H method, then at the control stage to maintain the quality of the performance of the WLC Autelan equipment does not decrease again in the next period, there are several steps that must be considered in the control stage including ensuring that the monitoring dashboard has been implemented for monitoring and health check control of all devices managed, activate an active backup system on all WLC and ensure device maintenance both from room temperature, physical device, and logical configuration.

### Conclusion

Based on the discussion that has been described, the following conclusions can be drawn:

1. By using FGD with the parties involved in the maintenance of the Autelan WLC device, it was found that there were several factors that affected the decline in the performance quality of the Autelan WLC device which was shown using the fishbone diagram, 4 main problem factors namely measurement, machine, milieu, and method.
2. Problems that have been found using the help of fishbone diagrams are then proposed improvements using the 5W1H method. Some proposed improvements include making a monitoring dashboard for all managed devices, changing the WLC device system to active backup, carrying out preventive maintenance activities twice a year, and moving devices from a room with a stable room temperature so that the device does not overheat frequently.

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