ANALYSIS AND DESIGN WIRELESS NETWORK AND SECURITY BASED ON FIREWALL IN PIT MINING AREA PT ABC

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Abstract

The 4.0 Industrial revolution has entered the mining industry. One of them is the application of big data technology in PT ABC, a coal mining contractor in Indonesia. To support the project's performance, an extensive internet connection covering certain areas, including pit areas, is needed. However, there are areas outside the GSM or Wi-Fi service in PT ABC District XYZ. To solve the issue, proper planning and analysis of Wi-Fi network coverage development and firewall-based wireless security are needed to support the operational of big data technology in the company's internal system. The planning and development of this network coverage and wireless security use the Network Development Life Cycle (NDLC) method. This method is useful to continue the improvement on wireless network in PT XYZ. The benefit of the NDLC method is that when someday an alteration is needed on the network, life cycle data has been recorded in the NDLC method. The result of this study is a design that can fix or cover the deficiency of the existing network condition. The design is in the form of Access Point placement design and access network settings using wireless security.

Keywords: Wireless network; wireless security; firewall; NDLC; access point

Introduction

Various countries in the world, one of which is Indonesia, has entered the Era Revolution of Industry 4.0. In general, Industry 4.0 describes the growing trend towards automation and data exchange in technology and processes in the manufacturing industry (Hermann, Pentek, & Otto, 2016); (Landherr, Schneider, & Bauernhansl, 2016); (Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014). These trends include the Internet of Things (IoT), Industrial Internet of Things (IoT), cyber-physical systems (CPS), artificial intelligence (AI), smart factories, cloud computing systems, and so on. In addition to technology, the development of Big Data is also starting to affect our lives today (Suherman, Wijoyo, & Indrawan, 2020).

The use of the internet using wireless connectivity is an important part of the process of sending and receiving data between devices. Today's internet connection has become part of the needs of every individual, one of which is the use of Wi-Fi (Wireless Fidelity). Wi-Fi is one of the technologies of WLAN (Wireless Local Area Network),

which is commonly found in industrial sector. Wi-Fi Usageaccess to the internet continues to increase along with the increasing use of smartphones.

Wireless Local Area Network (WLAN) is a development of Local Area Network (LAN) (Jaringan Wireless et al., 2014). In WLAN no longer used cables for the process of sending and receiving data between devices. Thus, the network is easier to build without designing paths for cabling. In addition, the construction of WLAN is also relatively cheaper because there is no need for connecting cables between devices. Currently, WLAN has two frequencies used, namely at 2.4 GHz and 5 GHz.

One of the important parts of a Wi-Fi device is the Access Point (AP). Access point is interpreted as a device that can transmit signals to and from the receiver. These devices are very easy to find in the market at an affordable price. However, the device access point also sometimes gives problems, for example Improper placement of access points makes some location points into areas that get a bad Wi-Fi signal and may also not get a signal at all or known as the blankspot area.

The industrial revolution 4.0 has also entered the world of the mining industry. One of them is the use of big data technology in one of the coal mining contractor companies in Indonesia, namely PT ABC. To support the smooth running of the project, an internet connection is needed that covers certain areas, especially in the pit area. However, the actual conditions in the work environment at PT ABC District XYZ still have several location areas that are not covered by GSM or Wi-Fi networks at all. This will certainly disrupt the smooth operation of big data in the company's internal.

Therefore, the authors are interested in analyzing the planning for the development of Wi-Fi network coverage and wireless security in the blank spot area in the PT ABC pit District XYZ so that it can help the smooth operation of the use of big data technology in the company's internal.

Research Methods

This qualitative research was conducted in four blank spot areas in the PT ABC District XYZ pit using the Network Development Life Cycle development method. The method consists of six stages, including:

1. Analysis

Stage is carried out by analysis to obtain overall information regarding the development that will be carried out to suit user needs. The following is an overview of the initial topology of the development of Wi-Fi access in the corporate environment.
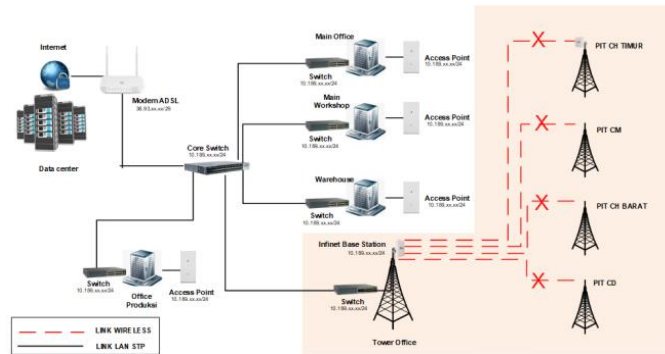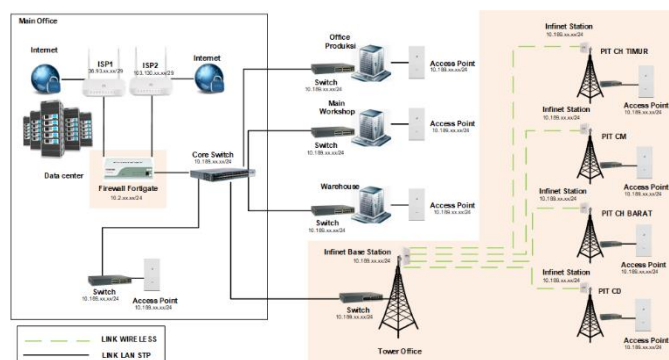
Figure 1
Initial Topology of Development

The wireless coverage development method used in this research is point-to-multipoint wireless coverage. This is because it is more cost-effective, reduces frequency interference, and is suitable for implementation in the development of PT ABC's wireless pit area coverage, District XYZ.

For the method of restricting user access, the method used is Firewall Packet Filtering. This type of method is used to filter data packets based on the specified address and options. The method is designed to control the flow of packets based on the origin, destination, port, and type of packet information contained in each packet.

2. Design

The following is the design for the development of wireless network coverage and the design of wireless security proposed in this study.

Figure 2
Wireless Topology and Wireless Security Development Plan

In the design of the development of wireless coverage, there is the installation of one point in the main office tower area as a Base Station, which will later reach the four location points.

While in the design of wireless security based on firewalls, there is a plan in bandwidth usage which are differentiated in each of the different department's user groups.

3. **Simulation Prototype**

In this study, a simulation was carried out using the InfiPlanner application which is then carried out several simulation tests to determine the required height in the placement of the Access Point repeater points to cover the required areas that have been described previously.

Meanwhile, for the simulation in the design of wireless security, this research was carried out directly with the configuration of the FortiGate device which was then tested directly using a gadget or laptop.

4. **Implementation**

This stage will take longer than the previous stage. In implementation Network Engineer implements everything that has been planned and previously designed.

Implementation is a very decisive stage of the success/failure of the project to be built and it is at this stage that Teamwork will be tested in the field to solve technical and non-technical problems.

5. **Monitoring**

After the implementation of the monitoring stage is an important stage, so that the computer and communication network can run according to the wishes and initial goals of the user in the early stages of analysis, it is necessary to carry out monitoring activities. In this study, the monitoring tools used are the monitoring tools, the dude mikrotik and cacti.

6. **Management**

Management or regulation, one of which is of particular concern is the issue of policy, policies need to be made to make/manage so that the system that has been built and runs well can last a long time and the element of reliability is maintained. The policy will depend on the management level policy and the company's business strategy, which should support the company's business strategy as much as possible.

Results and Discussion

A. Implementation

1. **Wireless Coverage Development Design**

From the results of determining the height with a simulation using the InfiPlanner tools needed for the installation of an access point to reach the location, the highest point is found in 4 areas, which is 39 meters. The following is the throughput of each connected station.
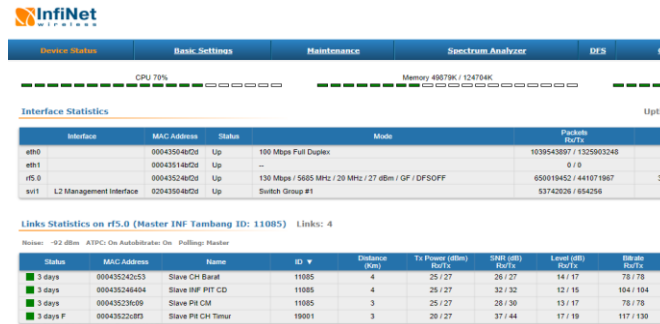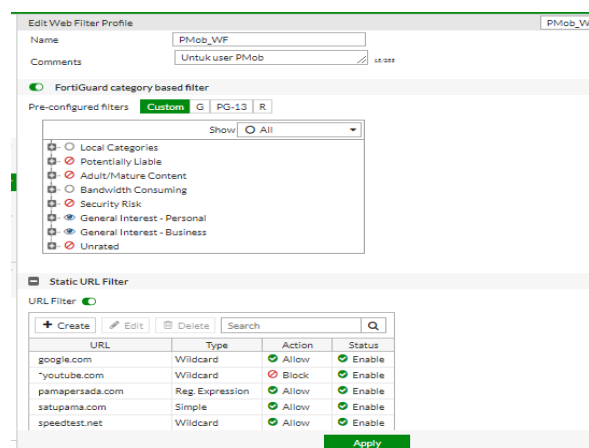
Figure 3
Throughput Results of All Stations in the Pit Area
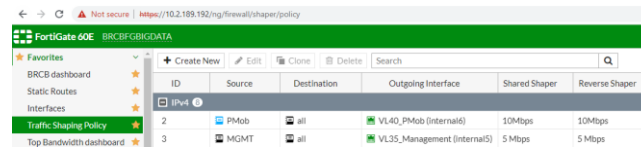
2. Wireless Security Development Design

Firewall-based wireless security configuration is done by using a FortiGate device. The role of FortiGate devices in limiting access rights is to restrict users from accessing websites and mobile applications.
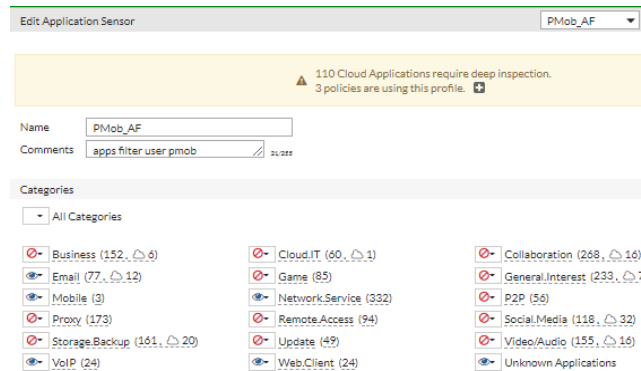
Figure 4
Configure Application Control

Figure 5
**Example of Wireless Web Filter Configuration**

Figure 6
Configuring Rules and Policies for Wi-Fi Access

After all the configuration is done, the ethernet interface on the previously configured FortiGate is directly connected to the company's core switch which we then give access to the new VLAN. In this case, we set it to VLAN 35 and VLAN 40. This is the VLAN that we will use later for Wi-Fi access all devices in the office area and mining area.

3. **Results of Monitoring Dashboard Design**

a) **The dude mikrotik**

The dude mikrotik is a built-in tool for mikrotik products that is used as monitoring network development of wireless coverage. To activate this feature, it is necessary to install this tool on two sides, namely on the server side (from the router board) and on the client side (client computer). Here's what the monitoring tools look like: the dude mikrotik after all repeater devices in the mine area has been added to the dashboard.
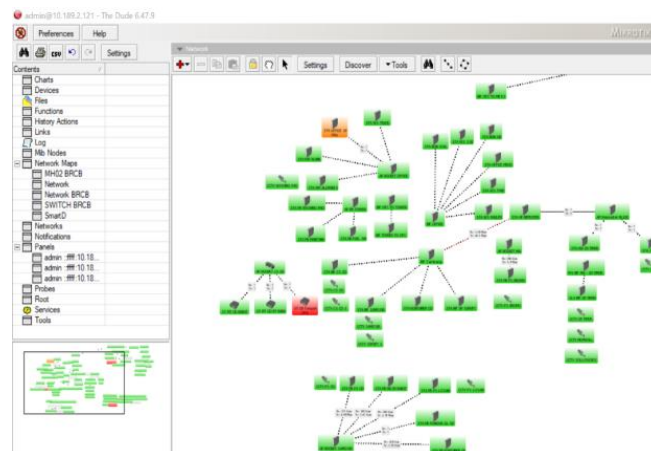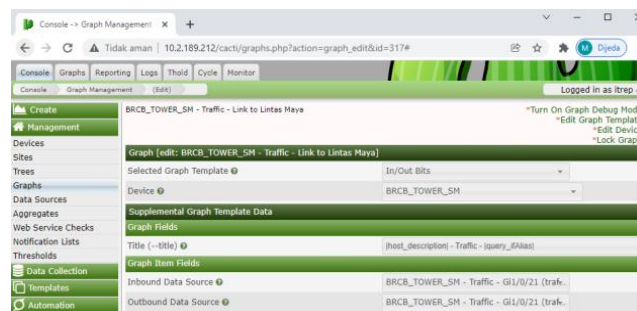

Figure 7
Display of the Dude Device Monitoring Dashboard

b) **Cacti**

In contrast to Dude Mikrotik, cacti are quite install on one of the computers that will be used as a server based on the Ubuntu operating system. To enable cacti, need to install the required packages like apache2 as a web server and MySQL as database server.
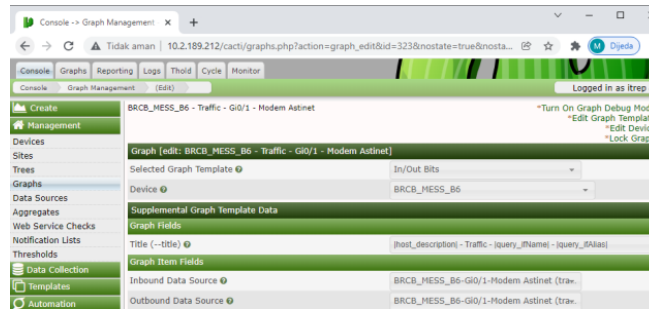
Figure 8
WAN 1 Monitoring Graph Configuration on Cacti

Figure 9
WAN 2 Monitoring Graph Configuration on Cacti

c) Unifi Controller

Unifi controller is the default software from Ubiquiti products that are used to manage and monitor a large number of unifi access point devices. Because in this study the access point used is an unifi device, so we need to install and configure this controller.

Figure 10
Adding an UniFi Access Point Device to the Controller

Figure 11
SSID Configuration on UniFi Controller

B. Testing and Evaluation
1. Result of the Speed test Internet access

In this step, internet access testing will be carried out by connecting to a Wi-Fi network access with the PMob SSID. Here is the results ratio test try internet access with using speedtest in each area where the repeater has been installed.

Table 1
Speedtest Test Results at Pit Locations

Location	Test	Results	
		Download	*Upload*
CD pit	*Speedtest*	4.26	3.97
East CH Pit	*Speedtest*	4.66	2.77
West CH Pit	*Speedtest*	3.32	2.43
CM pit	*Speedtest*	3.98	3.62

Speed test comparison in each area for Internet access has been met. In this case, it can be proven by the speed test results obtained in each area that have met the needs. Where in need to carry out big data processing transactions, a minimum bandwidth of 1 Mbps is required.

In addition, from the test results above, when referring to the Tiphon standard which has been discussed in the previous chapter, it can be described according to the following table:

Table 2
Speedtest Results Evaluation Table

| Category	CD pit	East CH Pit	West CH Pit	CM pit
Jitter	18 ms	35 ms	17 ms	33 ms
Loss Packet	3.9%	3.1%	3.3 %	5.7%

Loss Packet   3.9% 3.1% 3.3 % 5.7%

From these results, if converted into standard Tiphon QoS Parameters, the results of the speed test carried outfall into the medium category for Jitter and good for the Packet Loss category.
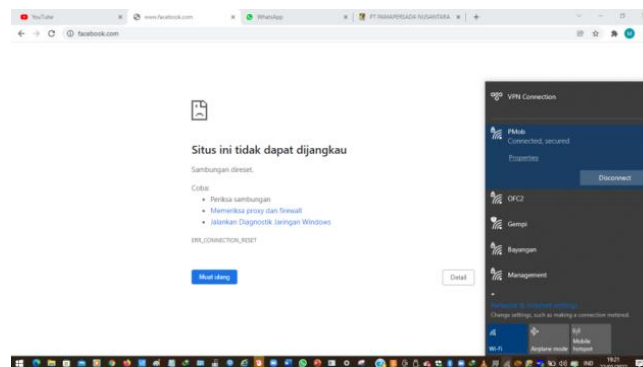
2. Results of Testing Wireless Security

At this stage, testing the configured wireless security configuration is carried out by accessing some websites that are allowed and not permitted in need. Here are the test results by accessing several applications that are in the firewall policy rule the one in the block.
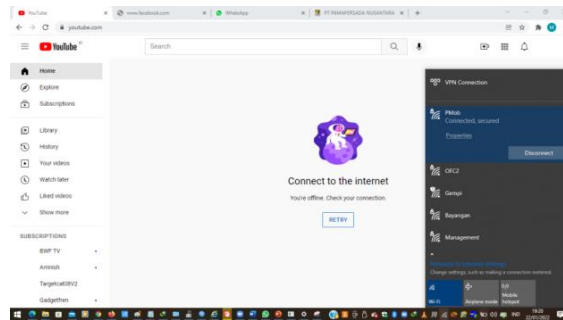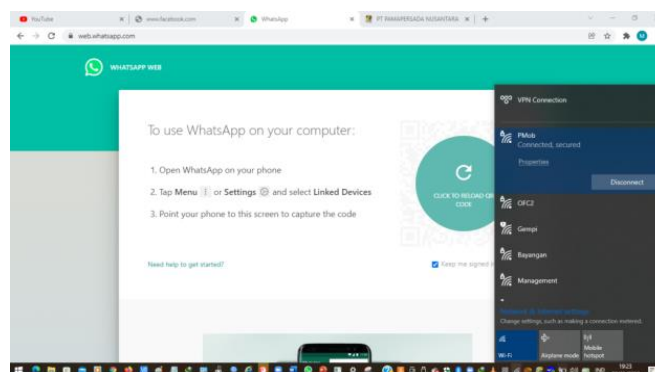

Figure 12
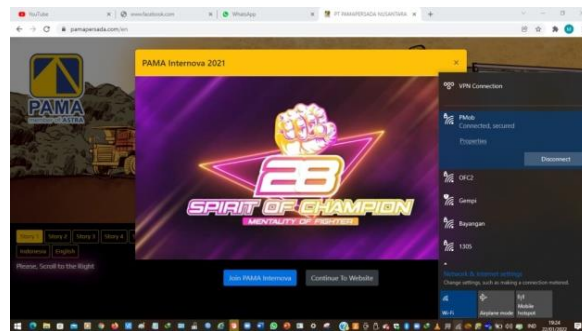**Test Results Try Accessing YouTube Pages**

Figure 13
Test Results Try Accessing Facebook Page

The display above indicates that wireless security is running well where users cannot access the website. The next test is to access several websites that are allowed by the firewall.

Figure 14
**Test Results Try Accessing WhatsApp Page**

Figure 15
Test Results for Access to Company Pages

In the display above the WhatsApp website can be accessed by the user. The rules and policies that we have previously set are running well.

3. Results of Testing Wireless Security

At this testing stage, bandwidth utilization testing will be carried out after the development wireless coverage and firewall-based wireless security.
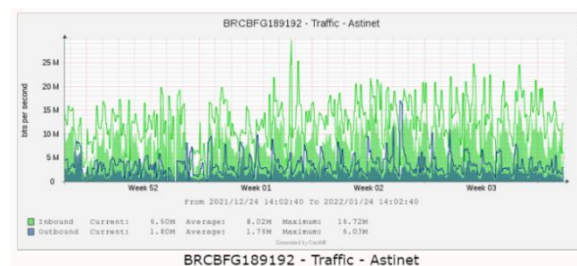
Figure 16
Astinet Traffic After Implementing Packet Filtering

In the graph above, it can be seen that the bandwidth utilization performance is stable even though it occasionally approaches over-capacity bandwidth. This will affect maintaining the stability of internet access.

Conclusion

Based on the results development that has been carried out, it can be concluded that: 1) with the method of developing point-to-multipoint wireless network coverage, there is an expansion of coverage wireless is about 25% of the previous condition wherefrom the results of the Q o S standard parameters of Tiphon all pit locations in the development design have obtained Wi-Fi coverage with the Jitter category it is in the medium-scale and for the packet loss category it is in the good scale with the addition of the following devices: a) basestation, addition of infinet Wireless R5000-Smnb/5.300.2x63.2x16 device - InfiMAN 2x2 on the station side in the tower office area at the height of 39 meters to reach all locations of wireless coverage development. b) station, in addition by using the device Infinet Wireless R5000-Smn/5.300.2x63.2x19 as a station at 4 pit locations. c) access Point Wi-Fi, Wi-Fi signal transmitters, UniFi Access Point devices are added in 4 locations that can be monitored directly from the

office area. 2) with the development method of wireless security packet filtering on FortiGate devices, it helps in maintaining the stability of bandwidth utilization where the average bandwidth utilization is still at 50% - 70% of the existing bandwidth capacity.

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