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Radius Server Design for Hotspot Management at SMK Negeri 1 Pogalan Trenggalek

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Abstract: The development of information technology makes it easier for humans to complete work. To meet communication needs at SMK Negeri 1 Pogalan, wireless networks are used. Users who access network services via wireless media only need to enter a shared key to use all resources, which makes wireless security vulnerable because it has only one security layer. In addition, all users do not yet have centrally controlled settings in real time. Authentication, Authorization, and Accounting (AAA) is a mechanism for verifying user data related to usernames and passwords, granting access rights to verified users, and recording user activities related to data flow through the system. This mechanism is available in the RADIUS protocol, which was built to provide these services. Collaboration between the RADIUS server and hotspot service on a proxy router that supports the AAA protocol is expected to improve network security. Testing, monitoring, and analysis were conducted using the PPDIOO method. The results show that using an external RADIUS server can enhance wireless network security, manage user settings, and monitor network usage in real time, making it easier for administrators to manage the network.

INTRODUCTION

Advancement is a form of change in the times. Currently, technology has developed very quickly, including technology in the field of information and communication. We as humans are always required to be able to adapt to every change if we do not want to lose opportunities in the fu-ture. Likewise, improving services for access to information within the school must also be aligned with the needs of all school residents so that all those who need information can be served properly.

Some of the impacts of technological developments are the emergence of various kinds of com-munication tools that have quite a lot of variants and

modern technology in the form of both hardware and software. One of the most striking

developments in the field of information technology is the rapid development in the field of computer networks and the internet.

Based on the main data of SMK sourced from page https://dapo.dikdasmen.kemdikbud.go.id/sekolah/3BEB1EB37227CD38E2B9 per December 7, 2019 for the 2019/2020 academic year, SMK Negeri 1 Pogalan Trenggalek Regency is recorded to have a total of 1884 students and 123 educators and education personnel (PTK), all of whom need access to information through cable and wireless interconnection media, although not always at the same time, just looking for information or to support learning in the classroom and outside the classroom in the school environment.

Currently, the computer network at SMK Negeri 1 Pogalan serves approximately 250 (two hun-dred) computers spread both in the laboratory and in the office, with details of 214 computers in the laboratory and the rest in office spaces, all connected in the network using cable network transmission media. In addition to a number of computers in the computer laboratory, SMK Negeri 1 Pogalan also has several wireless network devices such as 7 Wireless Access Points spread across several rooms.

Users Wireless Access Point does not have centralized management so that a network admin cannot know exactly the estimated number of users, who uses them, and from which wireless access points users can access or connect to the computer network at school. All students and teachers, in ad-dition to being able to access information from computer devices, students and teachers are also able to use smartphones to be able to connect in the school computer network at the same time so that there can be duplication of use.

Some of these things have an impact on overcapacity to all services on the computer network. Computer network management has so far still used a relatively simple method by only making set-tings on the main router device, without knowing who is using, how many users, how many devices each person uses, and how long the device used is connected to the school network.

By looking at the current state of network management, the Administrator feels the need to fur-ther improve the quality of user management, one of which is by improving a centralized security sys-tem to control and manage service users so that there is no double access for each user. By utilizing the Remote Authentication Dial In User Service which is able to carry out Authentication, Authorization, and Accounting (AAA) service management centrally for users who are connected and want to use re-sources in the network, it is considered suitable for further collaboration with existing network devices, in this case with a mikrotik router which is actually already It has an internal Radius Server feature called User Manager.

Even though there is already a radius feature in the mikrotik product, it does not mean that this feature can be used freely considering that in a mikrotik router device itself there are many services that are active to manage the network, it is feared that if added by activating the internal radius service to manage a large number of users, it will further increase the workload of the router itself, In addi-tion, not all Microtik router devices are able to handle a large number of users, depending on the de-vice license used.

It is hoped that a centralized management system can ensure that only users who are registered on the management server can use network services so that the use of the internet is more effective ac-cording to the needs and interests of users considering that service users continue to increase every year and the need for information access is also increasing while bandwidth allocation which is limited according to the school's financial ability to subscribe to the internet. It is hoped that efforts to improve the management of user management systems and security in the network can be a solution for schools to be able to optimize the use of internet information access through school networks.

From the above series of backgrounds, the researcher concluded that it is necessary to build a centralized network management system so that it is expected to be the best solution in an effort to im-prove network security and optimize the use of information access in school networks. So this study the author gave the title: "Radius Server Design as a System Management Hotspot on the Computer Network of SMK Negeri 1 Pogalan".

A. *Computer network*

Nathan Lord Ryan (2018). Computer network is a relationship between two or more sepa-rate computer systems, through communication media to communicate to communicate data with each other to share resources (resources), sharing resources including data (sharing files), databases, hardware resources (sharing printers, DVD-Drives, etc.).

B. *Server*

The server is the control center of the computer network, usually in the form of a high-speed computer with a large RAM capacity and a large enough hard disk space. The operating system used is a special operating system that can provide various services for workstations

C. *Workstation*

All computers connected to the network can be said to be workstations. This computer accesses the server to get the services that have been provided by the server.

D. *Hotspot*

Onno W. Purbo (2006) in his book entitled "Wireless and Hotspot Handbook" explains the meaning of Hotspot is a limited area served by one or more sets of 802.11a/b/g standard Access Point Wireless LAB. Where users can enter Access points freely and mobile using devices such as notebooks, laptops, PDAs and so on.

E. *Radius*

Martin P. Clark. (2003) In his book entitled *"Data Network IP and the Internet"* explains what *Remote Authentication Dial-In User Service* (RADIUS) is. Radius allows centralized user centralization of databases that store user authorization data in the database so that only any registered user can be granted permission before they can access the Internet or IP network.

F. *FreeRadius*

(Fauzan, 2012)Freeradius is an open source-based security protocol radius server that works using a client-server system and supports MySQL, Freeradius is used to authenticate users through communication be-tween client and server to access the network).

G. MikroTik RouterOS

Ika Adman Satya (2006), Mikrotik routerOS is a software router that can use embedded equipment (minimum system) or use PC (personal computer) and is compatible with IBM PC X86. Mikrotik routeOS is built using the Linux kernel, a wide range of network management software and is packaged into one proprietary software and manufactured by Mikrotik in Latvia.

RESEARCH METHODS

In the process of designing radius servers as a system management hotspot, this system uses a network lifecycle model with the concept of PPDIOO, namely, Prepare, Plan, Design, Implement, Operate and Optimize, according to CCDA 640-864 Official Cert Guide. (2011, p11), Cisco has developed a network planning lifecycle formula, into six phases: Prepare, Plan, Design, Implement, Operate, and Optimize.

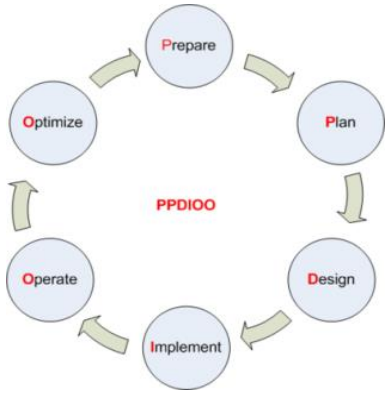

Figure 1. PPDIOO Model Turnover Pattern

A. Preparation Stage

At this stage, observations are made to the research site to find out and find out the needs of the agency/organization, make a network strategy, and propose a high-level license architecture for the development of computer networks at SMKN 1 Pogalan

B. Planning Stage (Plan)

1. Identify the network topology.
2. Hardware Identification
3. Router
4. Client PC

5. Wireless Access Point
6. Ketesedian Bandwith Internet
7. Monitoring

C. Design Stage

This stage is the creation of a security system scheme on the computer network at SMKN 1 Pogalan. Net-work topology or network architecture is an overview of the planning of relationships between computers in a Local Area Network which generally uses cables (as transmission media), with connectors, ethernet cards, and other supporting devices (Melfin Syafrizal: 2005, p.39).

D. Implementation Stage

The implementation stage this time is to start designing a radius server in accordance with development in the following stages:

1. Install the Ubuntu 18.04 LTS operating system on the radius server.
2. Installasi Lamp
3. Installasi Mariadb
4. Freeradius installation and configuration
5. Installation of the daloradius and its configuration

E. Operating Stage

1. Server Testing and Monitoring

At this stage, testing and monitoring are carried out the results of designing the radius server as a system management hotspot. At this testing stage, testing was carried out on the radius server that had been de-signed by conducting a AAA (authentication, authorization, accounting) test whether it was running or not. This test can be done by testing users who are already registered in the database and users who are not yet registered in the database, whether the user gets access rights or gets rejected. Testing can be done with two events, namely testing from the server side and testing from the client side.

a) Server-side testing

The test from the server side this time is to test users who have been registered and users who have not been registered in the freeradius database via daloradius on the Config□Test User connectivity□ menu then enter the username and password according to the provisions in table 1 as follows:

Table 1. User list for radius server testing

Identitas	Already Registered	User Not Registered
User	Xinjiang	naruto
Password	2000-12-30	12345
Attribute	Rate-limit 256k/256k	Rate-limit 256k/256k

The test on registered users yielded the following results, these results show that the registered us-ers are allowed to get the service marked with an Access-Accept message and get permission to get an al-location of bandwidth with 256k upload and 256k downloads as shown in figure 2 as follows:

Figure 2. Test User who is already registered in the radius server database

For the next test, a test is carried out on users who have not been registered in the radius server da-tabase, from the test results the user gets a rejection marked with an Access-Reject message as shown in figure 3 as follows:

Figure 3. Test Users who are not yet registered in the radius server database

From the test results of the two users, you can also get a report on the results of the authentication, authorization, accounting process on the Last Connections Attempts report menu on the radius server as shown in the following figure 4:

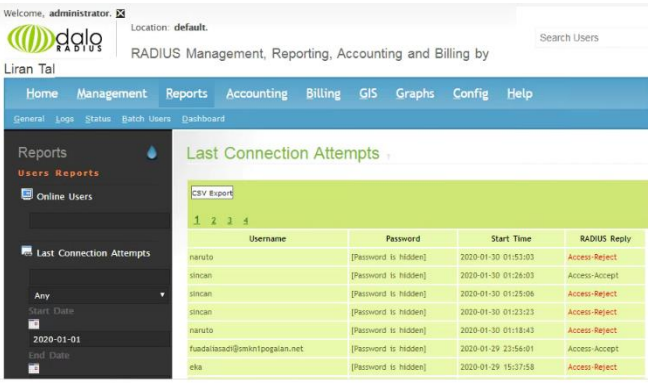

Figure 4. Report of the last connection attempt in AAA on the radius server.

b) Client-side testing

Testing on the client side is carried out for testing as well as testing on the server, but the difference is that testing from the client side is done on a computer that acts as a client connected to a wireless ac-cess point that has been set up hotspot in the previous stage. From the test results, the results were ob-tained that the user registered with the name Sincan successfully logged in and received internet service as shown in figure 5, while the user in the name of Naruto did not succeed in logging in because it had not been registered in the database as shown in figure 5 as follows:

Figure 5. User syncan successfully logs in

Figure 6. User naruto failed to login.

If the check is done through daloradius on the Reports□Last Connection Attempts□ menu, the two users have different replies, which can be seen in the RADIUS Replay status, for the access received is marked with an Access-Accept message while the user who gets a rejection has an Access-Reject status as shown in figure 7 as follows:

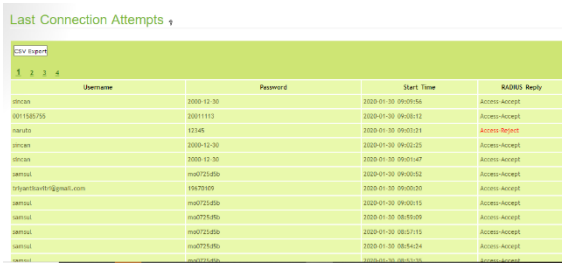

Figure 7. Report - Last Connection Attempt

2. Data Monitoring and Analysis

At the stage, monitoring and data collection are carried out with darkstat software such as the network condition before it was developed. In addition, monitoring is also carried out on the dalradius software in order to find out the number of service users, how large packages the user uses, and from which IP Address the service user uses it.

3. Maintenance

In this study, no repairs were made (maintenance) because the radius server was running well, but for network development in the future it is necessary to implement security improve-ments using better authentication methods, not only using the PAP (Password Authentication Protocol) authentication method.

F. Optimization Stage

This stage includes analyzing the results of development to find out the disadvantages and advantages of the condition of the network before it is developed and the network after it is developed.

RESULTS AND DISCUSSION

A. Analysis of Results.

In addition to being able to conclude from the results of the analysis of monitoring usage for several days, it can also be concluded that the condition of the network before and after development certainly has its own disadvantages and advantages. This is explained in table 2 comparison of network conditions both before development and after development as follows:

Table 2. Analysis of data packet usage by users/Day

No	Tanggal Pengambilan Data	Total Percobaan	Rata-Rata Waktu/Jam	Rata-Rata Pemakaian/Byte		Total Pemakaian	
				Tx/MB	Rx/MB	Tx/MB	Rx/MB
1	28 Januarai 2020	42	4.63	12.52	12.52	525.83	3914
2	29 Januarai 2020	58	3.96	10.08	46.88	584.90	2719
3	30 Januarai 2020	64	5.58	34.99	219.17	2239.58	14027
4	31 Januarai 2020	83	3.73	22.06	122.84	1830.68	10196
5	01 Pebruari 2020	40	1.05	8.04	95.68	321.67	3827
6	02 Pebruari 2020	10	2.30	11.36	144.94	113.57	1449
7	03 Pebruari 2020	141	2.36	15.59	125.99	2197.65	17765
8	04 Pebruari 2020	233	2.78	10.07	78.72	2347.14	18342
	Rata-Rata/Hari	84	3.30	15.59	105.84	1.2 Gb	8.8 Gb

From the analysis of usage for eight consecutive days, it was found that the average login attempt reached 84 attempts and with the total usage, it can be seen from the amount of upload(tx) and download(rx) traffic of 12 Gb for upload and 8.8 Gb for download.

B. Comparison of Network Conditions.

In addition to being able to conclude from the results of the analysis of monitoring usage for several days, it can also be concluded that the condition of the network before and after development certainly has its own disadvantages and

advantages. This is explained in table 3. comparison of network conditions both before development and after development as follows:

Table 3. Comparison Before and After the Network was developed

Advantages and Disadvantages	Network Before Developed	Network After Developed
Users have a dependency on a single server manager	*x*	√
Users can use network *resources* freely without being controlled	√	*x*
The user must be registered on the server	*x*	√
Use of different *usernames* and *passwords* on each different hotspot	√	*x*
The use of the service by the user can certainly be regulated and determined.	*x*	√
Users are always asked to log in when the session ends	*x*	√
Users must remember all *passwords* on different wireless devices	√	*x*
User usage can be monitored centrally	*x*	√

Description: X = No √ = Yes

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the research in designing the radius server as a system management hotspot at SMKN 1 Pogalaan, it can be concluded that the design of the radius server using freeradius software is proven to be able to become a centralized user management server as evidenced by the results of usage monitoring, that all service usage can be recorded well in the server database so that all usage reports can be known, Furthermore, the reporting database can be analyzed for further conclusions to be drawn for further network development reference.

As for centralized user management, it is still necessary to involve a lot of microtic routers, considering that the settings supported on the server side of radius and dalo radius are still very limited, adjusting to the available dictionary attributes so that user management still has limitations in determining policy lines for the user authorization process.

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