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# Wireless Network Authentication System Using RADIUS (Remote Authentication Dial In-User Service) Server (Case Study: Universitas Muhammadiyah Riau)

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## KEYWORDS

Radius; Authentication, Internet; Hotspot; Wireless

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## ABSTRACT

The Universitas Muhammadiyah Riau has applied the application of wireless internet-based networks. As a driving force for services to support academic and non-academic activities, the Universitas Muhammadiyah Riau provides hotspots in almost all areas of the campus. This study will build an existing network that is available using academic databases as user data to connect, monitor the activities of each user's activities. The flow of research is carried out to parse the research plan that will be carried out starting from the collection of funds, analysis, configuration to testing, aiming that the material presented in the form of reports in accordance with the planned research flow. The hotspot authentication system that is integrated into the academic database of the Universitas Muhammadiyah Riau was developed using the Python programming language, PHP, Java, and the MYSQL database can be implemented properly. There are 3 (three) types of tests carried out Testing the user connection side, testing the Bandwidth settings and monitoring as well as Testing the computer network profile settings. The integration of the Muhammadiyah Riau University database server and RadiusDesk was successful so that the priority of sharing access to users could be mapped to the maximum.

## INTRODUCTION

The conceptual foundation of internet creation begins with the publication of 3 (three) research documents and 1 (one) proceeding document, which then changes the concept of human thinking related to future prediction technology that is more accurate [1]. In 2020, the distribution statistics of world internet users in some regions of the world reached 4,574,150,134 users with the highest percentage of the population coming from Asia, namely 55.1% or totalling 2,300,469,859 users [2], while in Indonesia in 2019 it became the 4th (fourth) country with the highest number of internet users, namely 171.26 Million users [3].

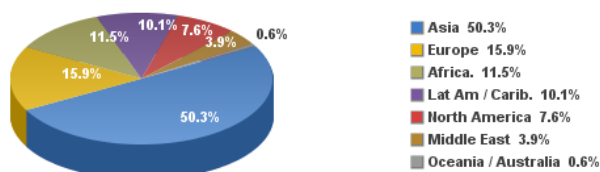


Figure 1. Distribution of internet users in the world - 2020, data dated March 3, 2020 (source: Internetworldstats.com/stats.htm).

Hotspot is an expression of an area that has wireless internet-based services. The word wireless is etymologically defined as "not having cable". In computer network terminology, wireless is a term used to describe computer networks in which there is no physical cable connection between the sender and receiver, but rather a network connected by radio waves and microwaves to maintain communication. Wireless systems use specialised equipment such as NICs, APs, and routers instead of cables (copper or optical fibre) for connectivity [4].

The Universitas Muhammadiyah Riau has applied the application of wireless internet-based networks. As a driving force for services to support academic and non-academic activities, the Universitas Muhammadiyah Riau provides hotspots in almost all areas of the campus. Internet services are provided to every academic community consisting of students, lecturers, educators and guests. Each academic community has educational information that is managed independently by the Universitas Muhammadiyah Riau through the Integrated Management and Information Management System (SMART) of the Universitas Muhammadiyah Riau.

Observations made by the authors in each Hotspot area found that there are Access Point / Hotspot points that do not implement a

centralized authentication system that is integrated into the user's academic database (Students, Lecturers, Guests and Educators). Findings in the field found that some Access Points still apply one-password authentication for one Access Point and Hotspot and vary each device so that it impacts on users (Students, Lecturers, Guests and Researchers) who cannot enjoy internet services because they do not have access. The access point service. Another weakness is related to the absence of centralized authentication to users, namely the lack of monitoring functions of internet network users and the difficulty of mapping bandwidth requirements in each Hotspot area.

Authentication in a computer network is needed, because Network Authentication is a security process that is needed when a computer on a network tries to connect to a server to use its resources, only if the user's identity has been saved by the server the same as the username and password entered is valid, then the user will get a connection.

Research on the application of centralized authentication on the internet network has been carried out by several researchers such as Musliyana (2014), producing a Hotspot service that uses a web-based registration service and uses MySQL as a database to store Hotspot user data during the registration data storage process takes place, the data will be parsed into the proxy radius database server by utilizing the Mikrotik PHP Class API [5]. Furthermore, Apolinarius Gusala et al. (2016) implemented freeradius on a Hotspot network where freeradius functions as a server to store Hotspot User data [6].

This research will build an existing network that is available using an academic database as user data to connect, monitor the activities of each user's activities and develop internet services at the Universitas Muhammadiyah Riau.

## LITERATUR REVIEW

### Hotspot

A hotspot is a physical location where people can access the Internet, usually using Wi-Fi, through a wireless local area network (WLAN) with a router that is connected to an Internet service provider. Most people refer to this location as a " Hotspot Wi -fi" or "connection Wi -fi ". Hotspots are usually located in public locations, which provide internet access to mobile devices such as your laptop or smartphone when away from work or home [7].

Table 1. Sinyal Lurus

	A.K.A	Tujuan
<b>WLAN</b>	Wireless local area network, wireless LAN	Allows mobile devices to communicate wirelessly using radio or infrared signals
<b>WiMAX</b>	Worldwide Interoperability for Microwave Access	Once considered the successor to Wi-Fi, offering wireless broadband access before giving up on competing for wireless standards

### 5G

Will offer higher data speeds, faster Internet connections, and download speeds (when launched in 2020)

### Remote Acces Dial-in Pengguna Service (Radius) Server

RADIUS is an Internet standard protocol that provides centralized authentication, accounting and IP management services for remote access users in distributed dial-up networks. The RADIUS client-server model has a Network Access Server (NAS) that operates as a client to the RADIUS server. The system, acting as NAS, sends user and connection information to the designated RADIUS server using the RADIUS standard protocol defined in RFC 2865. The RADIUS server acts at the request of the user connection that is received by authenticating the user and then returns all required configuration information to the NAS, so NAS (system) can provide official services to authenticated dial-in users [8].

### Free Radius

FreeRADIUS merupakan aplikasi pihak ketiga dengan lisensi open source, FreeRADIUS mendukung beberapa sistem operasi antara lain Linux dan BSD. FreeRADIUS menggunakan bantuan beberapa backend database yaitu MySQL dan PostgreSQL, dan Oracle untuk menyimpan data-datanya. FreeRADIUS adalah sebuah Radius Server berbentuk modul yang berfungsi sebagai protokol otentikasi pada suatu jaringan (Network Access Control). Dengan fungsinya itu, maka FreeRADIUS dapat digunakan dalam sistem *Log In* untuk menangani authentication, authorization, dan accounting. FreeRADIUS dapat digabungkan dengan layanan Mikrotik *Hotspot* sebagai external AAA Server [9].

FreeRADIUS has the following features:

1. Has a high performance, supports HA, Fail-Over.
2. Rich in features, supports many Operating Systems, EAP (encryption type), Database, AAA functionality, Virtual Server, Proxy, etc.
3. Modular, additional addon/plugin support.
4. Scalability, for high loads FreeRADIUS support is based on the maximum request and maximum server ( CPU ).

Table 2. Freeradius feature

Information	User Manager	Freeradius
Limited hardware resource	✓	X
Voucher	✓	✓
Supports HA, Fail-Over	X	✓
Profile Creation	✓	✓
Bandwidth settings User profile	✓	✓
User Monitoring session / active user	✓	✓
Supports AAA	✓	✓
Supports PAP authentication	X	✓
Support text files, LDAP, SQL, PostgreSQL, Oracle	X	✓

## Desk Radius

*Radiusdesk* is a web-based wireless *Hotspot* manager that was built to work on *freeradius*. *RadiusDesk* was built with modern web technology as a central dashboard ( *webtop* ) to manage users, devices, vouchers, *freeradius*, debugging, pages specifically for *coovachilli* and open source. *Radiusdesk* was started in early 2013 by Dirk Van Der Walt. Dirk started a similar project called *YFI Hotspot* manager. *Radiusdesk* is built on *Freeradius* and is designed to run on *apache* or *Nginx* web servers

The *RadiusDesk* features are as follows:

- Access Providers
- Realms
- Vouchers
- Permanent *Users* s
- Devices
- Profiles
- NAS Device
- Dynamic *Log In* Pages
- MESHdesk
- APdesk

Examples of the application of management *Users*, groups, and *bandwidth* are often found on public *hotspots* such as *WIFI.ID*, *Superwifi*, and also on *indihome* internet triple play. Within the *radiusdesk* group is created and configured in the realms menu, to add *Users* to the profile menu, in the profile menu, it can also adjust *bandwidth* according to the *user's* needs. [10 ]

## Mikrotik Router

A router is a network device that can connect one network to another. Routers work using the routing table stored in their memory to make decisions about where and how packets are sent. A router is a device that is dedicated to handling connections between two or more networks that are connected via packet switching. Routers work with seeing the source address and destination address of the packet passing through it and decide on the route that will pass the packet to reach its destination. The router knows the address of each computer in its local network environment, knows the address of the bridge, and other routers. A router can transmit data or information from one network other different, the router is similar to the bridge, although no smarter than the bridge, the development of device routers these days have begun to reach even beyond the limits of the expected technological guidance. The router will look for the best path to send a message based on the destination address and the origin address.

The router knows the address of each computer in its local network environment, bridges and other routers. The router can also find out the entire network by looking at the busiest side of the name and can pull data from the busy side until the side is clean [11]

## Review Literatur

Table 3. Comparison of algorithms (study literature)

Method	Advantages	Deficiency
<b>API PHP Mikrotik[12]</b>	<i>Hotspot</i> service integration system with academic data is available on Mikrotik	Absence of <i>bandwidth</i> sharing features
<b>EAP-TLS[13]</b>	The EAP-TLS protocol can work well and can be	No group <i>Users Hotspot</i>

	used as an authentication process. EAP-TLS can provide double security to secure a <i>Hotspot</i> network even though there are still applications that are able to enter the system	and also the distribution of <i>bandwidth</i> to <i>users Hotspot</i> such
<b>Multi-Nas[14]</b>	FreeRADIUS server can provide a better level of WiFi network security because with an encrypted authentication system, on the server side it will be safer in safeguarding <i>User</i> data that is connected to a WiFi network	no distribution of <i>user grub</i> and <i>bandwidth</i>
<b>LDAP[15]</b>	Each server is integrated with and connected to the campus internet network, and RADIUS servers can access LDAP database servers using <i>radtest</i> .	interface processing <i>user</i> is not there, and also there is no sharing of <i>bandwidth</i> to <i>users</i> of its

## METHOD

The flow of research is carried out to parse the research plan that will be carried out starting from the collection of funds, analysis, configuration to testing, aiming that the material presented in the form of reports in accordance with the research flow that has been planned. The steps to be taken in this study are as shown below :

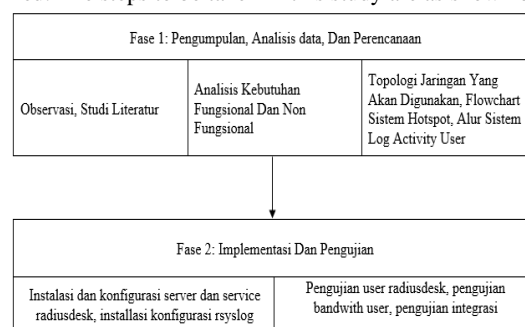


Figure 1. Research Flow

## Data collection

The stages are carried out by direct observation to the Universitas Muhammadiyah Riau, by looking directly at the Access Point located at the Universitas Muhammadiyah Riau and collecting data needed to identify problems and conduct literature studies on matters related to this research.

## Analysis

Some of the results of the analysis applied in this study are as follows:

Table 4. Functional Requirements

No	Functional Requirements
	<i>Log In users use academic system accounts.</i>
1	
2	
3	
4	

Table 5. Non-Functional Requirements

No	Device	Specification
<b>Hardware</b>		
1	Router	Routerboard 941-2nd – hap lite
2	UTP cable	type straight
3	UNIFI	Ubiquiti Unifi AP AC pro
4	Toshiba Laptop Satellite L745	Core i3, 500 GB, eight Gb
<b>Software</b>		
5	Operating system	Ubuntu 16.04
6	Tool	winbox v3.18 Mozilla firefox quantum 59.0.1 Virtual box 5. Unfi controller 5.6.40

An Internet network topology that is applied at the Universitas Muhammadiyah Riau.

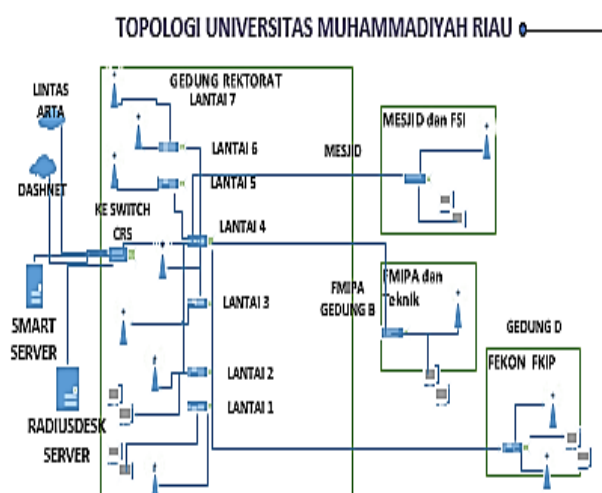


Figure 2. Computer network topology at Universitas Muhammadiyah Riau

Internet provider services at the Universitas Muhammadiyah Riau use two (2) Companies provider that Lintas Arta by the number bandwidth 70 Mbps and Dashnet 70 Mbps. Allocated to Server and User devices. Based on the network topology (Figure 3) illustrated network design *Hotspot* with *User name* NIM and NPK integrated with academic databases, and database servers radius can update the database server Muhammadiyah Riau University academic system.

The flowchart is used to illustrate the flow of the *Hotspot* network system that will be designed. The flowchart begins with Hotspot users finding wifi and connecting to the device will automatically open the Hotspot *login* page and enter the User Name in the form of NIM or NPK and password, then the Hotspot system will check into the database if the NPK and password match then it will

redirect to the web and internet connection will be active if the User Name and password that the user input is incorrect then it will return to the *login* page.

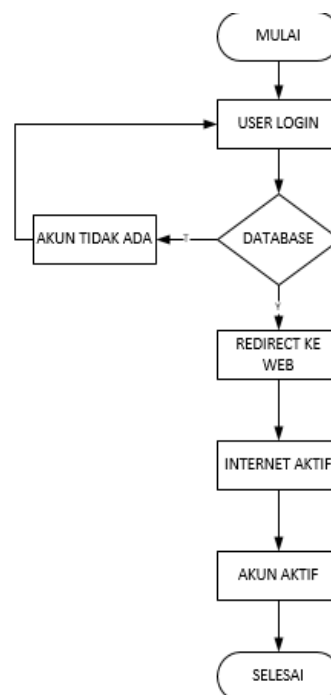


Figure 3. Hotspot System Flow Chart

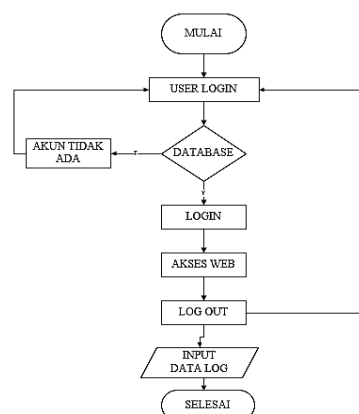


Figure 4. User Log flowchart

Users Log are stored in the server, at the moment Users Log In to Hotspot and me enter the Username in the form of NIM or NPK and password. Furthermore, the server will check the availability of the account, and if the account is available to log in and internet access is active, when the user accesses the HTTP site then the log will be stored in the database, the log is stored in the log system that is log in, accessed web, logout and also access point used.

## Implementation

Universitas Muhammadiyah Riau wears isp which are in use are Lintasarta 70 Mbps and dash net 70 Mbps, so the total bandwidth used by Universitas Muhammadiyah Riau is 140 Mbps, 20 Mbps allocated to servers and 120 for Internet services in the Universitas Muhammadiyah Riau. To divide the bandwidth evenly, the number of active users is divided by the amount of available bandwidth. The total bandwidth of 120 Mbps : 545 User

= 0.22 Mbps, 225 Kbps for the amount of bandwidth per user of its (Figure 6).

Before installing RadiusDesk, an advance configuration of IP addresses on the server ubuntu is static, in this study which will be installed into the server application is radiusdesk who use services such as python, phpMyAdmin, MySQL, PHP (Figure 7).

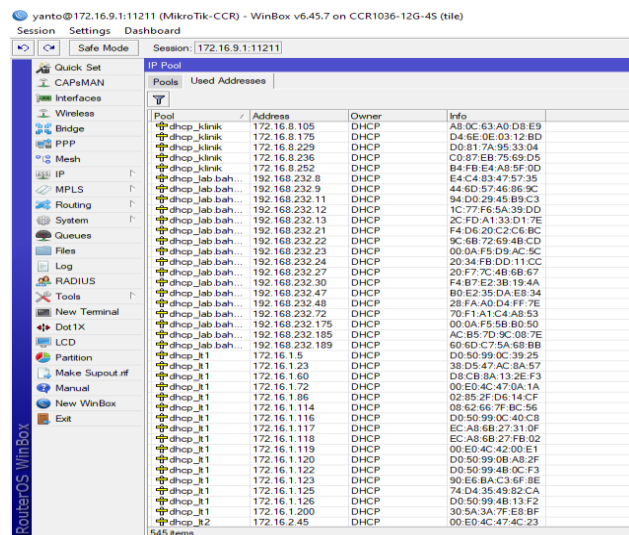


Figure 5 shows a screenshot of the MikroTik WinBox interface. The 'IP Pools' tab is selected, displaying a table of configured IP pools. The table has columns for Pool, Address, Owner, and Info. It lists multiple pools for 'dhcp\_klinik' and 'dhcp\_jab.bah' with their respective IP ranges and DHCP settings.

Pool	Address	Owner	Info
dhcp_klinik	172.16.8.105	DHCP	A8:0C:63:A0:D8:E9
dhcp_klinik	172.16.8.175	DHCP	D4:6E:0E:03:12:BD
dhcp_klinik	172.16.8.229	DHCP	D0:81:7A:95:33:04
dhcp_klinik	172.16.8.236	DHCP	C0:87:BE:75:69:05
dhcp_klinik	172.16.8.252	DHCP	B4:FB:E4:A8:5F:0D
dhcp_jab.bah	192.168.232.8	DHCP	E4:C4:63:47:57:35
dhcp_jab.bah	192.168.232.9	DHCP	44:6D:57:46:86:9C
dhcp_jab.bah	192.168.232.11	DHCP	94:D0:29:45:B9:C3
dhcp_jab.bah	192.168.232.12	DHCP	1C:77:F6:5A:39:D0
dhcp_jab.bah	192.168.232.13	DHCP	2C:FD:A1:33:D1:7E
dhcp_jab.bah	192.168.232.21	DHCP	F4:D6:20:C2:C6:BC
dhcp_jab.bah	192.168.232.22	DHCP	9C:6B:72:69:4B:CD
dhcp_jab.bah	192.168.232.23	DHCP	00:0A:F5:D9:AC:5C
dhcp_jab.bah	192.168.232.24	DHCP	20:34:FB:DD:11:CC
dhcp_jab.bah	192.168.232.27	DHCP	20:F7:7C:4B:68:67
dhcp_jab.bah	192.168.232.30	DHCP	F4:B7:E2:3B:19:4A
dhcp_jab.bah	192.168.232.47	DHCP	B0:E2:35:DA:E8:34
dhcp_jab.bah	192.168.232.48	DHCP	28:FA:A0:D4:FF:7E
dhcp_jab.bah	192.168.232.72	DHCP	70:F1:A1:C4:A8:53
dhcp_jab.bah	192.168.232.175	DHCP	00:0A:F5:B8:50:50
dhcp_jab.bah	192.168.232.185	DHCP	AC:85:70:9C:08:7E
dhcp_jab.bah	192.168.232.189	DHCP	60:6D:C7:5A:68:BB
dhcp_i1	172.16.1.5	DHCP	D0:50:99:0C:39:25
dhcp_i1	172.16.1.23	DHCP	38:D5:47:AC:8A:57
dhcp_i1	172.16.1.60	DHCP	D8:CB:8A:13:2E:F3
dhcp_i1	172.16.1.72	DHCP	00:E0:4C:47:0A:1A
dhcp_i1	172.16.1.86	DHCP	02:85:2F:D6:14:CF
dhcp_i1	172.16.1.114	DHCP	08:62:66:7F:BC:56
dhcp_i1	172.16.1.116	DHCP	D0:50:99:0C:40:C8
dhcp_i1	172.16.1.117	DHCP	EC:A8:6B:27:31:0F
dhcp_i1	172.16.1.118	DHCP	EC:A8:6B:27:FB:02
dhcp_i1	172.16.1.119	DHCP	00:E0:4C:42:00:E1
dhcp_i1	172.16.1.120	DHCP	D0:50:99:0B:A8:2F
dhcp_i1	172.16.1.122	DHCP	D0:50:99:4B:0C:F3
dhcp_i1	172.16.1.123	DHCP	90:E6:8A:C3:6F:8E
dhcp_i1	172.16.1.125	DHCP	74:D4:35:49:82:CA
dhcp_i1	172.16.1.126	DHCP	D0:50:99:4B:13:F2
dhcp_i1	172.16.1.200	DHCP	30:5A:3A:7F:E8:BF
dhcp_i2	172.16.2.45	DHCP	00:E0:4C:47:4C:23

Figure 5. Number of Active Users

```
root@radiusdesk:/home/coba# nano /etc/network/interfaces_
```

Figure 6. Command Enter Interface Ubuntu Server.

Interface server that has given IP static i.e. 192.168.10.0 192.168.10.254 with network and broadcast 192.168.10.255

```
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto enp0s3
iface enp0s3 inet static
address 192.168.10.254
netmask 255.255.255.0
network 192.168.10.0
broadcast 192.168.10.255
gateway 192.168.10.1
```

Figure 7. IP Static Configuration

Pering ifconfig to see whether IP server was replaced or not and then press enter to run the command.

```
root@radiusdesk:/home/coba# ifconfig
enp0s3 Link encap:Ethernet HWaddr 08:00:27:46:59:f3
inet addr:192.168.10.254 Bcast:192.168.10.255 Mask:255.255.255.0
inet6 addr: fe80::a00:27ff:fe46:59f3/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:20 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:1368 (1.3 KB)
```

Figure 8. Server Interface Checking

Radius installation is done after the required services have been fulfilled, such as MySql- Server and phpMyAdmin.

```
==== RADIUSDesk Installer 1.2.2 ====

1) (I) Install RADIUSDesk
2) Install RADIUSDesk + [C] JoomlaChilli
Select an Option or [q] to Quit: 1
Installing RADIUSDesk

PLAY (default) =====

TASK [Gathering Facts] =====
ok: [localhost]

TASK [radiusdesk : Checking for Supported Ubuntu Release] =====
skipping: [localhost]
```

Figure 9. RadiusDesk installation process

Rsyslog is an application that is used for logging *Hotspot* activity logs into the server, logs from *Users* recorded to the server i.e. the HTTP sites that are accessed, *Log In* info and *User* logouts. rsyslog configuration file on the Ubuntu server is required so that the rsyslog application runs on the server

```
# /etc/rsyslog.conf Configuration file for rsyslog.

# For more information see
# /usr/share/doc/rsyslog-doc/html/rsyslog_conf.html

# Default logging rules can be found in /etc/rsyslog.d/50-default.conf

##### MODULES #####

module(load="imuxsock") # provides support for local system logging
module(load="imklog") # provides kernel logging support
#module(load="immark") # provides --MARK-- message capability

# provides UDP syslog reception
module(load="imudp")
input(type="imudp" port="514")

# provides TCP syslog reception
module(load="imtcp")
input(type="imtcp" port="514")

# Enable non-kernel facility klog messages
$KLogPermitNonKernelFacility on
```

Figure 10. Configure the Rsyslog.conf file

Visible *Log In* to the system *radiusdesk*, to display the system *radiusdesk* namely IP server in the browser 192.168.10.254/ rd and *Log In* to the system *radiusdesk* to pass configuration further connected to the router proxy.

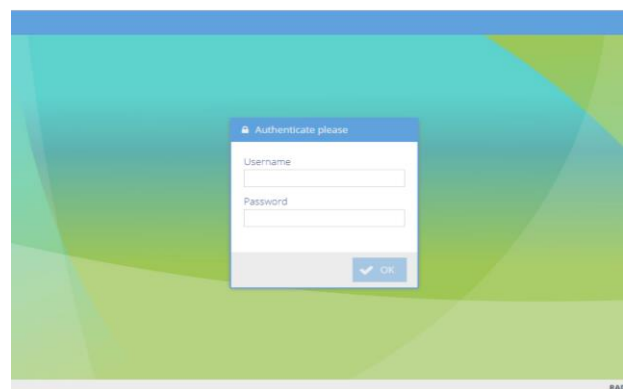


Figure 11. Display of Radiusdesk Log In

Interface MikroTik accessed via winbox version of 3:18 where ether 3 with IP 192.168.10.1 will connect to a system *radiusdesk*. Server *radiusdesk* will be connected to the proxy through ether3, then back to the system *radiusdesk* to continue the configuration. Several other configurations are required as in

Several other configurations are required as in

1. Realms, which is intended to create a location that contains a group of users consisting of students, lecturers, teaching staff and guests.
2. *Profile Settings Component* is enabled to set the allocation of User *Bandwidth* following *realms*.



3. Profile settings are used to store individual user *group* settings which include *upload* and *Download Bandwidth* restrictions.
4. *User* Permanent used to store *user* data in the form of a *User Name* and password used to connect to a *Hotspot* network connected to the *RadiusDesk* system

## Testing

Stages of testing include testing the *hotspot user*, *bandwidth*, and server integration into the Muhammadiyah University Riau database server. *Hotspot User* Testing is done by accessing Access Points and connections that have been prepared.

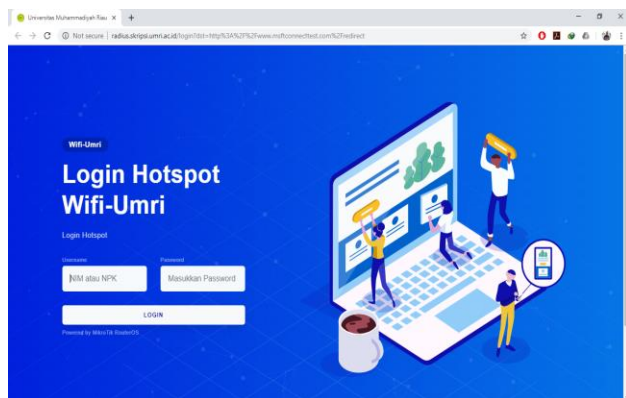


Figure 12. Home Log In

This page appears when the user has successfully connected with the Access Point of Muhammadiyah Riau University. Users must enter the NIM ( Student ) or NPK ( Lecturers or Staffs) and password corresponding to the Sistem Informasi Akademik Mahasiswa (SIAM) or SMART Universitas Muhammadiyah Riau. When the login connection is successful, the user can access the wifi-umri internet connection.

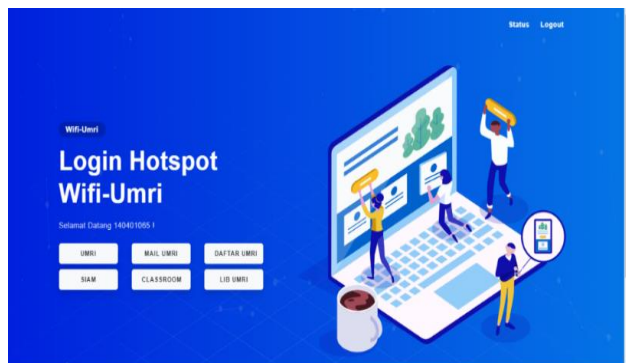


Figure 13. Internet access page when successfully logged in

Bandwidth testing is done by providing different bandwidth service quotas for each user profile.

1. Lecturer, bandwidth upload 225 Kbps, download 225 Kbps
2. Staff, upload bandwidth of 225 Kbps, download 225 Kbps
3. Students, upload bandwidth, is 225 Kbps, 225 Kbps
4. Guests, bandwidth upload 225 Kbps, download 225 Kbps.
5. Testing is done by utilizing the SpeedTest application.

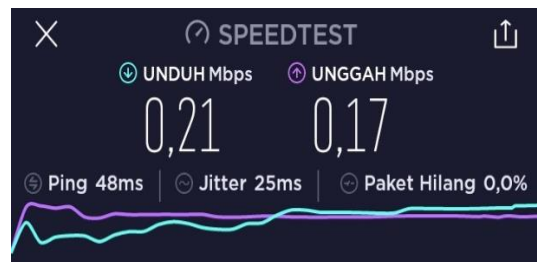


Figure 14. Testing the "Lecturer" *Bandwidth* measurement

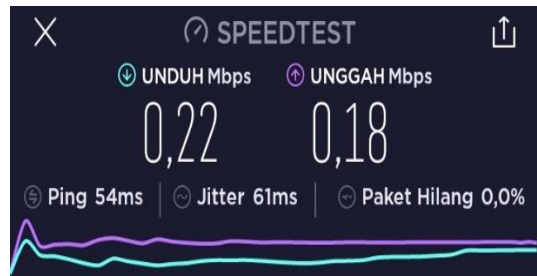


Figure 15. Testing measurement *bandwidth* " Staff."

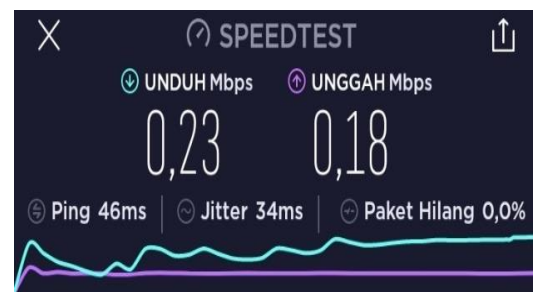


Figure 16. Testing the measurement of "Student" *Bandwidth*

After testing the speed of bandwidth on the entire profile for Lecturer, Staff, and students seem that the results speed test does not exceed the limit of Tela h given for each profile Users Hotspot.

Database integration testing is done by connecting before the User Name and Password have been changed and after being changed. To change the password for a Hotspot account, you can use the password change feature in SIAM or SMART. After changing, the Hotspot account will automatically follow the data in SMART or SIAM. When changing the password at SIAM, the password for the Hotspot account will change according to the SIAM password, after changing the password the next will be tested to Log In to the Hotspot network. If successful, the data in the academic system of the Universitas Muhammadiyah Riau has been integrated into the Hotspot system. Its radius.

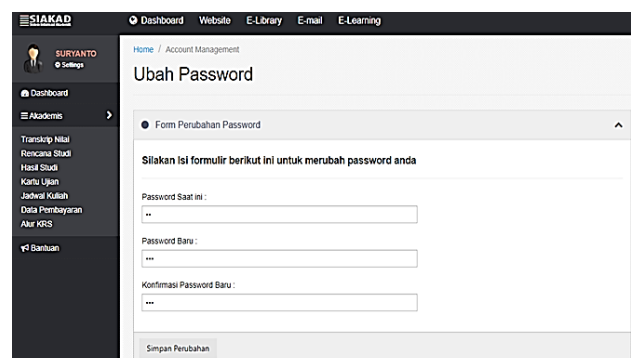


Figure 17. Form Change Password in SIAM.

When the tests *Log In* on the network *Hotspot* with the same user is found successful results.

Manual control testing is done by monitoring the *users* are active by groups such as lecturers, Staff, students and guests. Admin can see the amount of usage of *bandwidth* in each *User* her and also bi s a look at the log activity site HTTP which is accessed by the *user* as shown below.

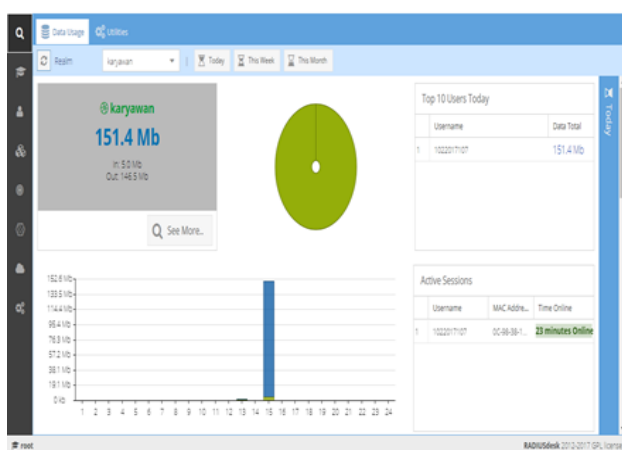


Figure 18. Monitoring Use Bandwidth Users Group Hotspot

Login session for hotspot users based on the date the user accesses the hotspot network

No.	Tanggal	Aksi
1	07 Jan 2020	Cek Data
2	06 Jan 2020	Cek Data
3	05 Jan 2020	Cek Data
4	04 Jan 2020	Cek Data
5	02 Jan 2020	Cek Data
6	28 Dec 2019	Cek Data
7	26 Dec 2019	Cek Data
8	20 Dec 2019	Cek Data
9	19 Dec 2019	Cek Data
10	04 Dec 2019	Cek Data

Figure 19. Monitoring User Login

The data usage feature in the RadiusDesk system functions to see active users and the amount of bandwidth used for each User. The system log can see Session Log In User, Log Log In User, Log Activity Users Hotspot.

52	2020-01-05 19:54:30	172.16.17.3 GET http://ocsp.digicert.com/MFEWt2BMEwStAIBglUgMCGgUA88TBL0V27R/Z7L8duomfzFnyB45SPUEwQUSZ1ZMUHWMysf action=allow cache=MISS
53	2020-01-05 19:54:30	172.16.17.3 GET http://siam.umri.ac.id/favicon.ico action=allow cache=MISS
54	2020-01-05 19:54:30	172.16.17.3 GET http://cldl.windowsupdate.com/msdownload/update/v3/static/trusted/en/disallowedcertstl.cab?26d226c60
55	2020-01-05 19:54:30	172.16.17.3 GET http://cldl.windowsupdate.com/msdownload/update/v3/static/trusted/en/disallowedcertstl.cab?24902fb0424c
56	2020-01-05 19:54:30	172.16.17.3 GET http://cldl.windowsupdate.com/msdownload/update/v3/static/trusted/en/disallowedcertstl.cab?2d3b215c65f
57	2020-01-05 19:54:30	172.16.17.3 GET http://cldl.windowsupdate.com/msdownload/update/v3/static/trusted/en/disallowedcertstl.cab?29ae6a5979f
58	2020-01-05 19:54:30	172.16.17.3 GET http://siam.umri.ac.id/beranda/images/bgpattern.jpg action=allow cache=MISS
59	2020-01-05 19:54:30	172.16.17.3 GET http://tile-service.weather.microsoft.com/en-US/livetile?region=US&appid=C98EA580842D8B9405Bf action=allow cache=MISS
60	2020-01-05 19:54:28	172.16.17.3 GET http://siam.umri.ac.id/beranda/js/behavior.js action=allow cache=MISS

Figure 20. Hotspot User Log Activity

Monitoring active Hotspot users can also directly access the proxy through the winbox. P no menu queue is also visible Users currently active or users who are accessing the hotspot and limit uploads and downloads for each user based right group which has at configures in the system RadiusDesk.

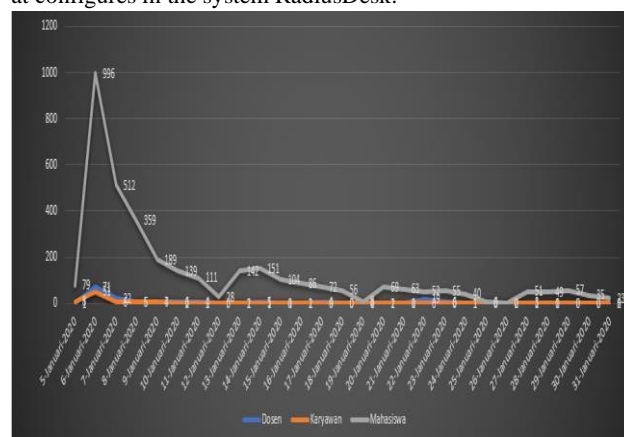


Figure 21. Internet User Charts (Data: 5 - 30 January 2020)

The results of the monitoring of network users Hotspot During January 2020 (5 -30 January) with the number of users as many as 3789 users look at the chart users Terban yak during January is Student. On January 6, 2020, as many as 1118 Users used Hotspots where 966 students, 71 lecturers, and 51 employees. That date was the date where the highest number of Users was during January 2020.

## RESULTS AND DISCUSSION

System authentication *hotspot* integrated into the academic database of the Universitas Muhammadiyah Riau developed using a programming language *python*, *PHP*, *java*, and the MySQL database can be implemented well. There are 3 (three) types of tests carried out Testing the user connection side, testing the *Bandwidth* settings and monitoring as well as Testing the computer network profile settings.

Internet access services at the Universitas Muhammadiyah Riau can be managed more leverage in for right results of testing that has been done generating activities of the user management ( monitoring activity, division of *bandwidth*, user name and password) hotspot can be done quickly because of database integration server the Universitas Muhammadiyah Riau and successful *RadiusDesk* so that the priority of sharing access to users can be mapped to the maximum.

Suggestions for further researchers, the development of this system in the future can be done, including:

1. Creating a *bandwidth* limit for users who download the process with large files.
2. We are presenting Notification of password changes to the user hotspot to email.
3. Calculation of the best hotspot layout to maximize the spread of access areas

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Completing the program S1 at Faculty of Industrial Technology, Islamic University of Indonesia (2012), Master of Information Technology at the same university (2015), and now attend a doctoral program at the Faculty of Mathematics and Science at the Institut

## APPENDICES

Table 6. hotspot user data that is logged 5-6 of January 2020

No	Date	Lecturer	Ten dik	Student	Total
1	5-Januari-2020	1	8	79	88
2	6-Januari-2020	71	51	996	1118
3	7-Januari-2020	22	6	512	540
4	8-Januari-2020	5	6	359	370
5	9-Januari-2020	7	4	189	200
6	10-Januari-2020	6	2	139	147
7	11-Januari-2020	4	2	111	117
8	12-Januari-2020	0	0	28	28
9	13-Januari-2020	2	1	142	145
9	14-Januari-2020	5	1	151	157
10	15-Januari-2020	1	0	104	105
11	16-Januari-2020	1	2	86	89
12	17-Januari-2020	4	0	72	76
13	18-Januari-2020	0	0	56	56



14	19-Januari-2020	1	0	8	9
15	20-Januari-2020	1	2	69	72
16	21-Januari-2020	1	0	63	64
17	22-Januari-2020	19	0	52	71
18	23-Januari-2020	6	0	55	61
19	24-Januari-2020	1	1	40	42
20	25-Januari-2020	0	0	6	6
21	26-Januari-2020	0	0	2	2
22	27-Januari-2020	1	3	51	55
23	28-Januari-2020	0	1	49	50
24	29-Januari-2020	0	0	57	57
25	30-Januari-2020	0	0	35	35
26	31-Januari-2020	2	0	23	25
<b>Total</b>					3785