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Performance Analysis of Wi-Fi Wireless Networks in A Vortex Media Access and Reseller Broadband

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ABSTRACT

The research aims to analyze network performance in an office and also a broadband reseller, to determine network quality through monitoring trials on servers and clients. The research uses data collection methods by conducting interviews. The second stage is needs analysis as a benchmark for network performance analysis. The next stage is monitoring the server and client to determine network speed. Research that has been carried out related to the analysis of Wi-Fi wireless networks in small and medium office environments using custom network topology to suit needs, as well as broadband resellers also using custom network topology. The distribution of bandwidth from each place adjusts to their respective needs to get quality network connections. The good thing is, that there are no specific standards for dividing bandwidth, it all depends on needs. The results of the data obtained from the analysis of the two places, of course from the analysis that the author has carried out, we can know the quality of the network connection from the two places, apart from that the topology design used by the office environment and also broadband resellers can increase knowledge about Wi-Fi wireless networks and can be an example to open a business in the field of Wi-Fi wireless networks that can provide faster Wi-Fi performance with wider coverage.

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1. INTRODUCTION

Currently, network use has progressed very rapidly and has been widely used. In communication technology, two transmission media play an important role. The first is cable media, where in this media the communication tool uses a cable network to communicate. The two are wireless media, where in this media there are two tools for communication, namely the access point and the wireless card. The development of

internet access technology has reached a stage where it can combine voice and image data services simultaneously by utilizing wireless-based access media [1].

Internet technology is currently experiencing developments that continue to increase every year. Along with the development of internet technology in Indonesia, many offices, campuses, and even schools are starting to develop these facilities to support work and education. Not a few offices have moved from using cable-based networks to WLAN or Wifi networks [2]. In the field of education, the Internet helps students in teaching and learning activities and currently the government is starting to use an online exam system and several schools are starting to use online report cards [3].

Internet usage in several offices currently has quite high access, for this reason, there is a need for network optimization, one of which is by managing users and bandwidth on the network in the office using a hotspot and QoS on a proxy. The aim is to manage internet resources so that later they can be utilized to the maximum extent possible between available bandwidth and existing users so that they are more efficient, optimal, and stable so as not to result in slow connections or users using the internet excessively, both for operational use around the office and use of facilities, other internet [4].

Network service providers usually install or position Access Points according to consumer requests, where errors often occur or the coverage or so-called network coverage is unstable and unreachable. In general, when installing a device in the form of an Access Point, it is usually placed in a position in the middle of the room or in a place where there is free space so that it can be installed and what often happens is that it is installed in a position close to a power source so that no additional Power Access Point cables are needed [5].

Quality of Service is the ability to provide performance from a computer network in providing services to applications on the computer network to determine the level of satisfaction of users who use the network[6]. The results of implementing the QoS (Quality of Service) method are intended to help Rimpis Multi Loket broadband resellers [7].

2. METHOD

This step includes measuring signal quality and testing network speed [8]. The research uses data collection methods, needs analysis as a benchmark for analyzing network performance, topology design for offices and broadband as an analysis of the topology used in each place, and also testing as a benchmark for analysis results.

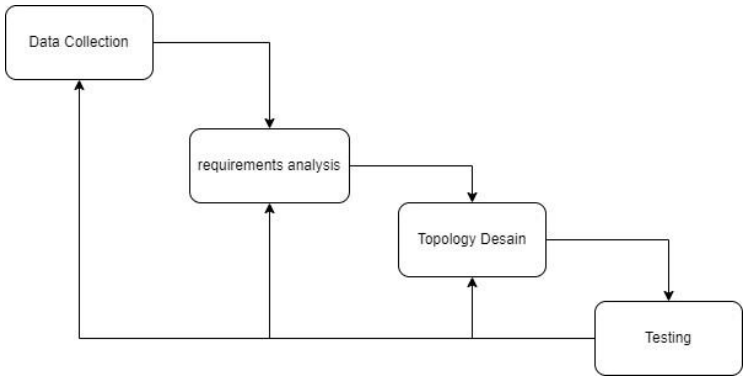

Figure 1. Waterfall use case Wi-Fi network analysis methodology

2. 1. Data collection

The data collection method used in this research is interviews. The author applies this method to collect the necessary data through questions and answers with the authorities, in this case, namely Vortex media access, including 50 users, and Rimpi's multi-lock, including 63 users. In this observation, the author obtained data from one broadband & office reseller, as follows:

a. User

1) There are 50 Wifi users at Vortex Media, including office technicians, office employees, and also several other users.
2) In the broadband reseller area (Rimpis Multi Locket), there are 63 Wifi users consisting of users and reseller owners.

2. 2. Needs Analysis

In this research, a tool is needed that is used to carry out QoS (Quality of Service) analysis. In this research, to find out the QOS and bandwidth used, the tool needed to create research results is Wireshark to monitor the data transfer process. The Wi-Fi monitoring QoS in this research is:

a. Wireshark

1) Open Wireshark
2) Then the connected Wi-Fi display will appear
3) Select the Wi-Fi that will be monitored
4) Then you will see the internet network traffic in real-time, such as time, source, destination, and also the type of protocol

2. 3. Topological Analysis

At this design stage, we will explain the network topology, and map how the network runs until it reaches the user before it is managed and after it is managed. It is hoped that this flow map and topology will provide a complete picture of existing needs. Make Mikrotik Hotspot Setup Settings, which will later be used to share bandwidth with clients [9].

a. Reseller Broadband

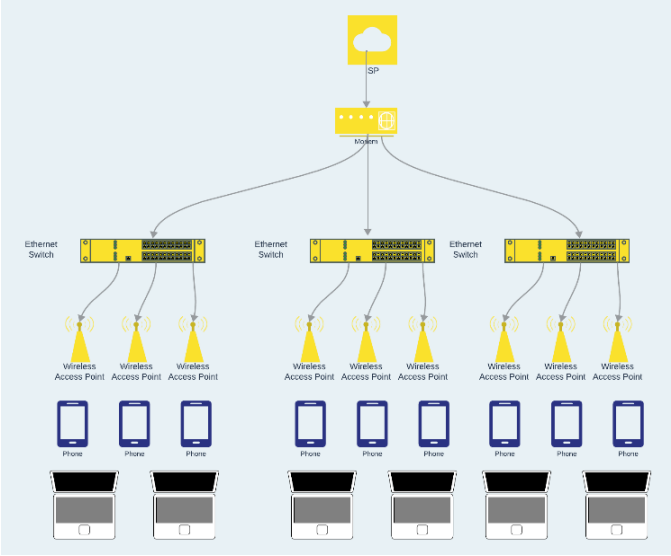

Figure 2. Custom Reseller Broadband (Rimpis Multi Locket) Topology

The topology above can be briefly explained as follows:

1) The internet from the ISP modem will be fed to the proxy which will later be distributed by the access point connected to the PoE switch.
2) The PoE switch is a special switch where this device can provide power to the Wi-Fi access point.
3) All equipment is connected using STP cat 5E cable which already has a grounding wire.
4) One access point for one client

Selection of WI-FI Device also known as a wifi transmitter, we need high specifications so that it can accommodate 20 users (1 client 1 device).

Figure 3. Broadband Reseller Access Point
Source: https://www.tembolok.id/membuat-jaringan-wifi/

1) The Wi-Fi device must be industrial/enterprise-class, and the price is usually around 2-3 million.
2) The enterprise Wi-Fi client is dual band (2G/5G) and supports Wi-Fi 5 technology (802.11.ac)
3) Later, clients will be educated to use 5G Wi-Fi so that the connection is smoother and more stable.
4) 2G Wi-Fi is only used for client cell phones that do not yet support 5G.

Selection of Main Router: The router referred to here is the one that functions as a bandwidth distribution center. Its position is below the ISP modem, so from the modem, it goes to the main router and then it is distributed to the access point. The routers commonly used are usually the Mikrotik brand.

Figure 4. Hub
Source: https://tradeinn.com/techinn/en/mikrotik-rb4011lgs-rm-10-ports-hub-switch/138061636/p

Mikrotik is affordable, has complete features and its toughness is unquestionable. You can set the bandwidth allowance for each client, or you can determine the bandwidth allowance per application, with the goal being to open important applications more smoothly. Meanwhile, for non-priority applications, we can only provide as much bandwidth as necessary so that does not slow down other users.

b. Vortex Media Access Office

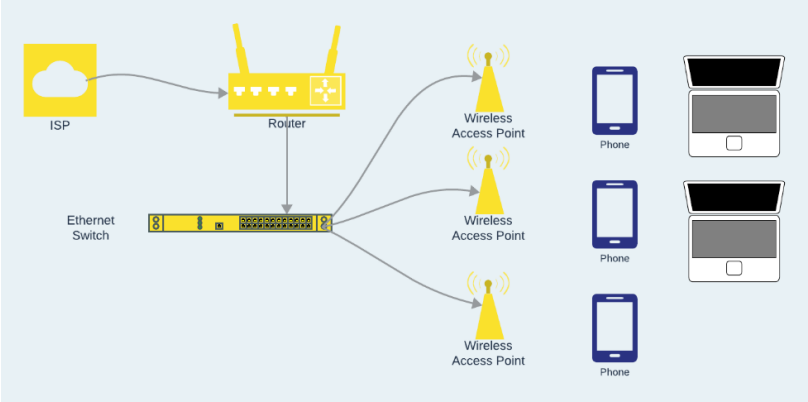

Figure 5. Custom topology at the VMA Office

The topology above can be briefly explained as follows:

1) This topology uses a hub or switch as a connection between one client and another. The location of the hub or switch is in the middle or center. If you want to send data from one computer to another computer, the data must first be channeled to a hub or switch.
2) The transmission medium used by the Star network is a UTP cable with an RJ 45 connector. This topology uses a hub switch or router, usually all installed computers will automatically connect their data.

Selection of WIFI Devices in the Office

Figure 6 Access points for office devices
Source: https://biznethome.net/

1) A high-speed internet connection, which is essential for office productivity allows users to smoothly run heavy applications and access the internet without interruption.
2) Equipped with high-security features, including firewalls and security policies. This is important for protecting sensitive data from cyberspace threats.
3) Can be upgraded according to office needs such as adding more bandwidth or capacity as your business grows.

Parent Router Selection

Figure 7. Modem

This is one of the best Wi-Fi routers for offices because of its wide range. A router with advanced technology, namely Beamforming, will increase the speed of the Wi-Fi signal to the maximum, making it attract the attention of many people. Has the ability to transmit a 5th generation 802.11ac Wi-Fi network with dual-band connection support. Due to the dual-band connection, this router can provide stable internet access speeds of up to 1167Mbps. With 4 high-gain antennas capable of transmitting stronger Wi-Fi. This unique and elegant design is only sold for 400 thousand rupiah.

2. 4. Testing

There are 2 topology tests that the author has carried out, namely topology testing on and topology on. The test results show that the use of the topology in broadband resellers and offices results in a significant increase in speed as follows:

a. On broadband resellers

1) Choose an internet service provider (ISP) company that has a big name, for example, Telkom, Biznet, and Firstmedia.
2) Start taking 100Mbps packages then look at the traffic, if it's not enough, you can add more.
3) Adjust the installation location for the access point, it can be on the ceiling or the wall.
4) Dualband means that in 1 Wi-Fi device, there are 2 transmitters (2GHz and 5GHz frequencies). It is better to use both so that it can accommodate many clients.

b. On the Office

1) Choose an ISP that has a big name, for example, Telkom, Biznet, and Firstmedia so that if problems occur they can be handled quickly.
2) Choose a Manageable HUB that suits your office needs. Make sure the AP has adequate bandwidth management capabilities.
3) Start taking the 1Gbps package because it will run smoothly for office needs, for example sending data, meetings, etc.
4) Limit Access to the wireless network to only authorized devices recognized this can be achieved by using strong encryption (such as WPA3).
5) Share 100Mbps on the Client PC/work PC so that data transmission is smooth without problems.

3. RESULTS AND DISCUSSIONS

The computer network currently running at VORTEX MEDIA ACCES Kalibaru is a LAN network. This computer network uses one switch to divide connections into several rooms. Referring to Figure 5. Star topology is the network model currently chosen by the network manager at VMA.

3.1 Results of Network Monitoring on RML

Table 1. Monitoring Table Results of Broadband Reseller Monitoring Data

Website	Average Throughput (bps)	Percentage (%)	Category Index	Point
www.facebook.com	457942	22,8	Bad	1
www.viva.co.id	463592	23,1	Bad	1
www.facebook.com	323151	10,7	Bad	1
www.viva.co.id	329882	10,9	Bad	1

www.facebook.com	294091	9,83	Bad	1
www.viva.co.id	296298	9,87	Bad	1
Website	**Average Postpone (m/s)**	**Percentage (%)**	**Point**	
www.facebook.com	69,15	-	4	
www.viva.co.id	66,95	-	4	
www.facebook.com	80,1	-	4	
www.viva.co.id	80,2	-	4	
www.facebook.com	88,6	-	4	
www.viva.co.id	99,1	-	4	
Website	**Average Packet Loss**	**Percentage (%)**	**Point**	
www.facebook.com	135	26,6	1	
www.viva.co.id	140	27,7	1	
www.facebook.com	151	29,7	1	
www.viva.co.id	154	30,4	1	
www.facebook.com	142	28	1	
www.viva.co.id	144	28,4	1	
Website	**Average Jitter (m/s)**	**Percentage (%)**	**Point**	
-	9,02	-	3	
-	10,23	-	3	
-	9,96	-	3	
45				
2.14				

Based on the final results of all parameters in the broadband reseller monitoring analysis results table (Rimpis Multi locket), the final index value was 2.14. This index value is in the medium range in the index category predicate. These results can be concluded that the quality of the Rimpis multi-locket network service is still not as expected. Therefore, for regular system maintenance, bandwidth capacity which is still too small needs to be added or increased. Also, good bandwidth management is needed by the network because with good maintenance you will get good results. The results of this test will be used as a source of information and analysis for broadband resellers and related offices to evaluate the quality of the internet network [10].

3.2 Network Monitoring Results on Vortex Media Access

Table 2. Monitoring Table VMA Monitoring Data Results

No	Time	Time 2	Time 1	Delay
1	0	0.029759	0	-0.02976
2	0.029759	0.033488	0.029759	-0.00373
3	0.033488	0.033488	0.033488	0
4	0.033488	0.040157	0.033488	-0.00667
5	0.040157	1.965943	0.040157	-1.92579
6	1.965943	0.196626	1.965943	1.769317
7	0.196626	1.966533	0.196626	-1.76991
8	1.966533	1.994369	1.966533	-0.02784
9	1.994369	2.001443	1.994369	-0.00707
10	2.001443	2.001443	2.001443	0
11	2.001443	2.007331	2.001443	-0.00589
12	2.007331	4.632469	2.007331	-2.62514
13	4.632469	4.634474	4.632469	-0.00201
14	4.634474	7.916662	4.634474	-3.28219
15	7.916662	7.917498	7.916662	-0.00084
16	7.917498	7.917698	7.917498	-0.0002
17	7.917698	7.929558	7.917698	-0.01186
18	7.929558	7.931315	7.929558	-0.00176
19	7.931315	7.931554	7.931315	-0.00024

20	7.931554	7.931664	7.931554	-0.00011
21	7.931664	7.939826	7.931664	-0.00816
22	7.939826	7.940049	7.939826	-0.00022
23	7.940049	7.940614	7.940049	-0.00057
24	7.940614	7.944036	7.940614	-0.00342
25	7.944036	7.944036	7.944036	0
26	7.944036	7.944036	7.944036	0
27	7.944036	7.944036	7.944036	0
28	7.944036	7.944036	7.944036	0
29	7.944036	7.944036	7.944036	0
30	7.944036	7.944036	7.944036	0
31	7.944036	7.944036	7.944036	0

The results of the analysis in the Vortex Media Access office monitoring table show that the calculation of throughput time at Time 1, Time 2, and Time 3 is approximately = 345 kbits/s (Throughput > 100) which means it has a performance aspect in the very good category with a ping below 5.

Packet loss analysis

Packet Loss is a parameter that describes a condition that shows the total number of lost packets that can occur due to collisions and congestion on the network. Here are the results of the packet loss analysis.
Packets Sent = 579 packets received = 579 packets sent = 579
Packet loss = Packets Sent - packets received / packets sent x 100
Packet loss = 579-579/579x100
Packet loss = 0% (no packet loss)
From the packet loss calculation results, the result is 0%, which means it has very good performance.

Delay Analysis

Delay is the time required for data to travel the distance from origin to destination. Delay can be influenced by distance, physical media, congestion, or long processing times. And from the results of the analysis, can be found as follows:
Delay = Time 2 – Time 1
Total Delay =12.230882 s Average Delay = 0.021124149 s x 1000 = 1.124 m/s.

Jitter Analysis

Jitter is caused by variations in queue length, data processing time, and also in packet reassembly time at the end of the jitter journey. Jitter is usually called delay variation, which is closely related to latency, which shows the amount of delay variation in data transmission on the network. The following are the results that have been analyzed:
Jitter = Delay 1 – Delay 2
Total Jitter =16.30811 s
Average Jitter = 0.028165993 s x 1000
Average Jitter = 8.165 m/s.
From the results that have been analyzed, it has good performance because it is in the numbers 0 to 75 m/s.

4. CONCLUSION

From the results of the Quality of Service analysis on the Vortex Media Access Office internet network, it can be concluded that the network quality values are as follows: Throughput = 345/kbits/s with a very good value, packet loss = 0%, namely the data packet loss is very small, close to zero, delay 1,124 ms with a very good value and jitter = 8,165 ms with an index of 5, which is good. Based on the results of the analysis as well as measurements and discussions on the Rimpis Multi Locket, the following conclusions can be drawn. The application of Mikrotik as a server router is still considered less than optimal because there are still many problems that occur on the internet network for each user when network traffic is congested, the result of which is that not all of the QoS parameters are in a good category. The bandwidth measurement results show poor results. This requires increasing or adding bandwidth capacity because the total bandwidth of the internet network is only 20 Mbps.

Furthermore, it is recommended to conduct further evaluation of the configuration and management of bandwidth usage on the Mikrotik router, as well as consider enhancing the network infrastructure to increase the total bandwidth capacity. Exploring additional or alternative technologies can also improve network efficiency and service quality, considering the escalating need for connectivity over time

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