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Hotspot Network Optimization Using Bandwidth Management with Simple Queue Method in Tangerang Vocational School

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Abstract:

Wireless is a wireless connection (wireless connection) using radio waves like wifi. Wifi (Wireless Fidelity) method of radio wave technology or access points so that users can transfer data quickly. One that affects users in using this wireless network is the range and signal. Because there are more and more users in the State Vocational School 1. In connection with the need for online information with the aim that information about the Vocational School 1 can be obtained more efficiently, by arranging it according to the needs using the LAN and Wireless Hotspot Network can be the solution. With a wireless network, users can browse from anywhere as long as they are within signal range. At SMK Negeri 1 Tangerang, the network does not cover all, and internet speed has not been stable because bandwidth has not been managed properly. This problem causes inequality of internet usage in schools and frequent collision data often occurs or often the internet connection is broken or loading is long. By implementing bandwidth management using the Simple Queue method on MikroTik RouterOS to divide the bandwidth of the client computer that is simple and easiest. Then performed performance analysis of each MikroTik RouterOS. The results of this study are by implementing bandwidth management the Simple Queue method makes wireless networks in SMK Negeri 1 Tangerang City stable and internet access through wireless networks can be used optimally.

Keywords —— **Wifi, Hotspot, LAN, Bandwidth, Access Points, Wireless, MikroTik.**

I. INTRODUCTION

Information technology, especially computer networks at this time has become one of the fundamental things in all aspects. It is difficult to imagine in the era of information technology as it is now without using computer network technology. This can be seen from the use of computernetworks in various forms, both corporate and personal. Computer network technology has become an important key in the era of globalization and information technology. One important technology and a trend in computer networks is wireless computer network technology (Wireless Local Area Network or WLAN).

This technology is a development of local computer network technology (Local Area Network) that allows efficiency in the implementation and development of computer networks because it can increase user mobility and remember the limitations of computer network technology using cable media.

The need for internet usage from year to year is increasing rapidly especially in the education sector such as vocational high schools (SMK). To facilitate internet use at SMK Negeri 1 Kota Tangerang especially for students of teachers and school employees, a wireless network is developed in the school area, to facilitate internet access.

At this time the bandwidth owned by SMK Negeri 1 Kota Tangerang is quite large and this bandwidth is only devoted to wireless networks, but with such a large amount of bandwidth there are stillproblems from the difficulty of getting internet access and not being maximally enjoyed by teacherstudents and school employees. And another problem is that when a user is accessing the internet via wifi, other users cannot enter or experience problems to be able to enter the network and carry out activities such as browsing and downloading. This problem is caused by not maximally regulating wireless network bandwidth in SMK Negeri 1 Tangerang City.

Simple Queue method is a method of measuring how well the network is and is an attempt to define the characteristics and properties of a service. Simple Queue method is used to measure a set ofperformance attributes that have been specified and associated with a service.

To overcome these problems, the application of the Simple Queue method that can be used one of them is by traffic shapping internet bandwidth techniqueson user wifi network. There are several methods inapplying the Simple Queue method of trafficbandwidth shapping techniques such as the First In First Out (PFIFO) Packets method.

Research on bandwidth optimization using trafficshapping has the conclusion that configuration ofbandwidth traffic shaping is done by separatingtraffic and applying bandwidth limitation usingsimple queue to maximize bandwidth usage so thatinternet usage is maximized.

Research on optimization analysis of the SimpleQueue method with the conclusion that a networkthat implements the First In First Out (PFIFO)Packets method as a Simple Queue optimizationproduces good categorized values based on theTIPHON standard.

Access the internet in a place where there is anaccess point or hotspot and users can use itsimultaneously without the need for a standard wificable.

In 802.11b GHZ can be operated for 3 channels soas not to interfere in a location. This weakness maybe overcome, if there is a migration to a higherstandard of 802.11a in the 5 GHZ spectrum. Wifialso accommodates mobility limits because like acellular network that provides seamless transfersfrom one base to another because of its easy useand many functions On the basis of the above theauthor feels the need to install a Wireless LANnetwork using Access Points to build hotspot areasto solve the problem by using the simple Queuemethod. In this case the author uses the PC RouterMicrotic program to manage the built hotspot network.

II. RESEARCH METHOD

A. Research Objectives

The author's intention to choose LAN Network and Wireless Hotspot Installation is as a means to facilitate teachers and students in obtaining information online and get to know about wireless in particular.

1. Using a wifi network in all school areas using the Simple Queue method
2. Using Management Bandwidth with the Simple Queue method

From using this hotspot system is to know the concept of a hotspot network and its configuration and find out the network topology

1. Theoretically, How to optimize wifi usage.
2. Practically, how to design wifi in all areas.

The benefits of research for the author are:

1. Get experience about Management Bandwidth in the simple Queue method.
2. Understand the Simple Queue method The benefits of research for SMK Negeri 1 Tangerang City are:
   a. Providing easy access to information for all community members in SMK Negeri 1 Tangerang City.
   b. Makes it easy in user management for wireless network users. As for the benefits of research for Science are:
      1. Expand knowledge
      2. Using the Simple Queue method and bandwidth management.

B. Basic Concepts of Computer Networks

Network or computer network history begins with time-sharing networks, namely the "series" of terminals connected to a central computer called a mainframe. Examples of IBM's System Network Architecture (SNA) time-sharing networks and Digital's network architecture then small-scale computers called Personal Computers or PCs are starting to "shift" mainframe computers. Some PCs can form a network called LAN (Local Area Network). LANs provide shared resource usage, such as file sharing and printer sharing. LAN is quite effective to use in closed areas with limited area, such as at home, office, laboratory, etc.

The existence of a wireless local network system or WLAN (Wireless Local Area Network) is very helpful for people who now have a higher level of mobility in the ease of connecting to the internet and data exchange. In the past, to connect to the internet, most people use cable, but now to connect to the internet, they can use wireless. Compared to using cable media, wireless has a lot of advantages including users can connect to the internet anytime and anywhere as long as it is within the scope of the area, in addition to the cost development, wireless is much cheaper when compared to cable. WLAN works by using radio waves. Radio signals spread from the sender to the receiver through free space, reflection, diffraction, Line of Sight and Obstructed LOS. This means that the radio signal arrives at the receiver through many paths (Multipath), where each signal (in different paths) has different levels of strength, delay and phase.

Every WLAN cell requires communication and traffic management. Which is done by Access Points (AP) that regulate communication at each wireless station in the coverage area. The station also communicates with each other through AP, so the process of communication between stations can be hidden from one another. In this case the AP functions as a relay. Among the APs are connected by means of wiring, if the area coverage is still in one environment, of course this is not a problem, 2 but what if the coverage of the area is so wide? This is what will make it difficult if you still use cabling techniques in connecting APs and also have an impact on financing.

To expand the range of radio signals produced by AP without using a cable, a system that is able to distribute between the signals transmitted by one AP is needed. To overcome these problems, a technique is needed, namely Wireless Distribution System (WDS). WDS has been widely applied in various agencies and companies in developed countries to connect between a network infrastructure with other network infrastructure that is far apart and is not recommended if the network uses a cable to connect the network. Data distribution system that still uses cable, or often called a wire distribution system, turns out that using a cable as a data distribution medium has many obstacles. One of the obstacles faced in the cable distribution system is the limited distance, the farther the distance travel the more cables that must be used and greatly affect the sending and receiving of data.

A network consists of 2 or more computers that are interconnected from one another, and share information. Computer network concepts were born in the 1940s in America, from group research Harvard University led by professor H. Aiken. At first the project only wanted to utilize a computer device that had to be shared. To work on several processes without wasting a lot of empty time, a Batch processing process is created, so that some programs can be run on a computer with a queue. There are several types of networks, namely:

1. Local Area Network (LAN)
   A LAN is a network that is limited by a relatively small area, generally limited by environmental areas.
2. Metropolitan Area Network (MAN)
   MAN usually covers an area larger than a LAN, for example between regions within a province that combine LAN networks.
3. Wide Area Network (WAN)
   WAN is a network whose scope is usually already used satellite or submarine cable facilities.

Wireless LANs or wireless local area networks that connect two or more computers or devices that use spectrum-scattered or technology-based OFDM modulation that allows limited communication between devices. It will provide users with mobility to move around a wide coverage area and still be able to connect to the network.

Wireless LAN works by using radio waves. Radio signals spread from the sender to the receiver through free space, reflection, diffraction, Line of Sight and Obstructed LOS. This means that the radio signal arrives at the receiver through many paths (Multipath), where each signal (on different paths) has different levels of strength, delay and phase.

Since wireless uses more open communication for communication media, Wired Equivalent Privacy (WEP), Wi-Fi Protected Access (WPA, WPA2) and Wireless Trans Layer Layer (WTLS) are used to ensure the security of computer wireless networks.

C. Simple Queue

On a network that has many clients, a bandwidthregulation mechanism is needed with the aim ofpreventing the monopoly of bandwidth usage sothat all clients can get their respective bandwidthquota. With Management Bandwidth, a simple queue method is used to meet these needs. In theMikrotik RouterOS, the simple queue method canbe applied. We can adjust bandwidth simply basedon the client's IP Address by determining themaximum upload and download speeds that can beachieved by the client.

D. Bandwidth

Bandwidth is a consumption value of data transfer that is calculated in bits / seconds or commonlyreferred to as bits per second (bps), between the server and the client in a certain time. Or thedefinition of bandwidth is the width or width of the frequency coverage used by the signal in thetransmission medium. So it can be concluded that bandwidth is the maximum capacity of acommunication path used to transfer data in seconds. The bandwidth function is to calculatedata transactions.

Bandwidth of computers in a computer network, this bandwidth is often used as a synonym for datatransfer rates, is the amount of data that can be taken from one point to another within a certainperiod (usually in seconds). Bandwidth on this computer network is generally measured in bits persecond (bps).

The research method used in this study is a network development method that has the aim to develop a more complete wifi path by conducting experiments, analysis, observations and interviews in the field. Data and information collected are from TKJ laboratory users consisting of the head of the expertise program, the teacher, and students and students.

Researchers conducted a method of direct analysis of any events that occurred in the system that was running in the Computer Engineering Laboratory of the SMK Negeri 1 Tangerang Network throughobservation / monitoring and interviews.

The number of bits received successfully per second through a system or communication media within a certain time interval. Generally throughput is represented in bits per second (bps) Linearity is a quantitative assessment of how strongly a data set is connected between onewith others. The reply time is what is needed by the web server to service the requests it receives.

Throughput is the number of bits received successfully per second through a system or communication media within a certain time interval. Generally throughput is represented in units of bits per second (bps).

CPU utilization shows the level of use of Central Processing Unit (CPU) for web server applications a performance comparison is performed with the parameters of reply time, throughput and CPU utilization. Comparing is done to get wireless network technology that has the best performanceparameters to be applied to the Computer Engineering Network of SMK Negeri 1 Tangerang. So that it can be said that this research study is a comparative study.

E. Data Collection Method

Data collection methods and information used by the author are as follows:

1. Library Studies

   Literature study is done by collecting data and information, by studying theories related toresearch and references from internet media, so that it can be used as a reference in research discussion and problem solving.

2. Interview

   The research was conducted by interviewing parties directly related to the research problem, namely the head of the expertise program, the teacher and students as wifi users. This data source is also very important to collect and follow up on research conducted.

   This method is carried out to determine the server resources that are running in the TKJ SMK Negeri1 laboratory to be used as analytical material. The observed data are:

   a. CPU / processor resources used on the server on the running system.

   b. Memory / RAM power source used on the server on the running system.

3. Direct Observation (Observation)

The researcher looked directly at the field, observed and studied the problem directly. Matching between temporary data obtained from various sources with realization in the field. This direct observation can collect data sources that are very clear and in accordance with reality in thefield.

This method is carried out to collect data relating to hardware and software used on the network with native servers. The data collected from the interview results are:

a. Hardware and software specifications.

b. Network topology. Analysis, Design.

System Weaknesses and Strengths

a. System Weaknesses

1. Intermittent connection
2. Configuration that does not match / not match
3. Interference signal source
4. Source signal attenuation / attenuation
5. Computer Virus
6. Damage to hardware or software drivers that are out of dated
7. Not successful wireless connection

b. Strengths of the system

1. Mobility: A wireless LAN system can provide users with real-time access information, anywherein an organization. This kind of mobility greatly supports productivity and improves service quality when compared to cable networks.
2. Installation Speed and Simplicity: Installing a wireless LAN system can be fast and very easy and can eliminate the need for cable withdrawals through roofs or walls.
3. Speed speed (faster).
4. Installation Flexibility: Wireless technology allows a network to reach places that cannot beachieved with a wired network.
5. Reduced Cost-of-Ownership (Reducing ownership costs): Although the initial investmentrequired by wireless LANs to buy hardware devices can be higher than the costs required bywired LAN hardware devices, if taken into account overall, installation and life-cycle the cost (Life cycle cost), is significantly cheaper. When used in a dynamic work environment that requires frequent movements and frequent changes,

the long-term benefits of a wireess LAN will be much greater when compared to wiredLAN.

Mobility: A wireless LAN system can provide users with real-time access information, anywherein an organization. This kind of mobility greatly supports productivity and improves service quality when compared to cable networks.
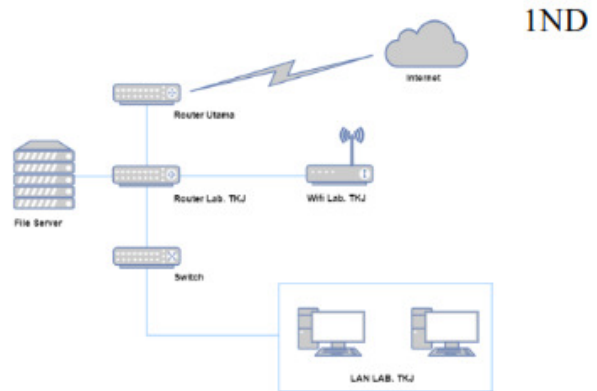

Figure 1. The network topology of the State Vocational School of Computer NetworkEngineering (TKJ) 1

F. Software

The software that is currently used in the TKJ STATE 1 Tangerang SMK Laboratory is:

1. Debian 7.4 based on GUI, as a native server operating system.
2. Samba, the application used as a file sharing service for the purposes of sharing resources in the TKJ Laboratory internal.
3. Windows 7 64-bit, as a client computer operating system.
4. Windows 8.1 Pro 64-bit, as a client computer operating system.
5. Debian 8.4 based on CLI / Text, as a client computer operating system.

III. RESULT AND DISCUSSION

A. Research Measurement Reseiver Data

Measuring the time needed by a data packet, fromthe time it is sent by the transmitter until it is received by the receiver.

Table I
Tiponon's delay in standardization

Latency Category	Large Delay
Very good	< 150 ms
Good	150 s/d 300
Being	300 s/d 450
Ugly	> 450 ms

1. Jitter

Defined as a change in latency in a period. Jitterdelays variation over time. Jitter is also defined asinterference with digital and analogcommunications caused by changes in signals dueto reference to the time position. The existence ofthis jitter can result in loss of data, especially inhigh-speed data transmission. In network implementation, this jitter value is expected to havea minimum value. In general there are fourcategories of network quality degradation based onjitter values according to the TIPHON version(Telecommunications and Internet ProtocolHarmonization Over Network) standardization ofjitter values.

2. Loss Package

Defined as failure of data packet transmission to reach its destination. The failure of the packagereaches the destination, can be caused by several possibilities, including that.
   a. Traffic overload occurs in the network.
   b. Collision (congestion) in the network.
   c. Error that occurs on physical media.

Failures that occur on the receiving side include bias caused by Overflow that occurs in the buffer. In network implementation, the value of packet lossis expected to have a minimum value. In general there are four categories of network quality degradation based on packet loss values inaccordance with the version of TIPHON (Telecommunications and Internet Protocol Harmonization Over Network) standard of packet loss values;

Table II
Standardizes Tiphon's version of jitter

Degradation Category	Peak Jitter
Very good	0 ms
Good	0 to 75 ms
Being	76 to 125 ms
Ugly	125s / d225

Testing and measuring software according to Pressman is a critical element of software qualityassurance and presenting basic studies of specifications, design and coding. In addition, testing can also be interpreted as a process of executing a program with the intention of findingerrors.

Measurement results are averaged and analyzed by comparing Jitter and Pakect loss. From the resultsof the experiment it is known that the least delay and most stable in accordance with the TIPHONstandard.
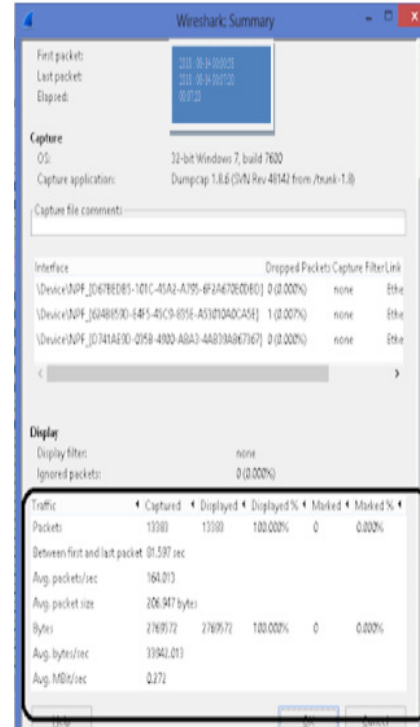

Figure 2. Comparison of Jitter and Packet Loss

Jitter is the difference in the arrival time of a packet to the recipient with the expected time. The jitter can cause the sampling on the receiving side to be not right on target, so the information becomes corrupt.

Packet Loss is the number of packets lost on a packet network caused by collisions, full networkcapacity, and packet loss caused by the expirationof the TTL (Time To Live) package. Delay is the time delay when the packet is caused by the transmission process from one point to another point which is the destination. Delay is obtained from the difference in time sent between

one TCP packet and another packet represented in units of seconds.

Throughput is the average speed of data received by a node within a certain time interval. Throughput is the actual bandwidth at that time where we are connecting. The unit has the samebandwidth as mbps.

Download is a process of transmitting a file or data from a computer system to another computersystem. From the internet, the user or user who downloads (downloads) is the process by which auser requests or requests a file from anothercomputer (such as: web site, server or the like) and then receives it. In other words, downloading is the transmission of files from the internet to the client or user computer can also be said to be the process of receiving or retrieving files from the internet or server to a personal computer.

Upload is often said also with Upload, which is a way to send files (such as files: images, programs, music, pdf documents, etc.) from a personal computer to a server system and files or data will be published on the internet so the data that has been uploaded can be seen and taken (downloaded) by other people or people.

Another definition of upload is the process of transmitting a file or data from a personal computer system to another computer system (server) in the opposite direction to the download. From the internet network, the user who does the upload process is the process by which the user sends the file to another computer requesting the file. In short, the process of transmitting or sending files or data, from personal computers to the internet network.

B. Testing

1. Black Box testing

By way of working the proxy is to capture the request of the client web page and then redirect it to the proxy web page that has been modified for authentication login. User data and password willbe transferred to the radius server for the authentication process and authorization of accessrights before being able to access the internet. After the user is logged in by entering the correct username and password or has been authenticated in the database, the proxy will also

display a logout page that functions to decide wifi network connection.

In accessing the system that is already registered and is using a wifi network, it will be monitored on the web administrator page, this is intended to find out whether users using the wifi network can be seen or detected in handling requests. After entering the web administrator, it will then control or monitor users and bandwidth usage as shown below.
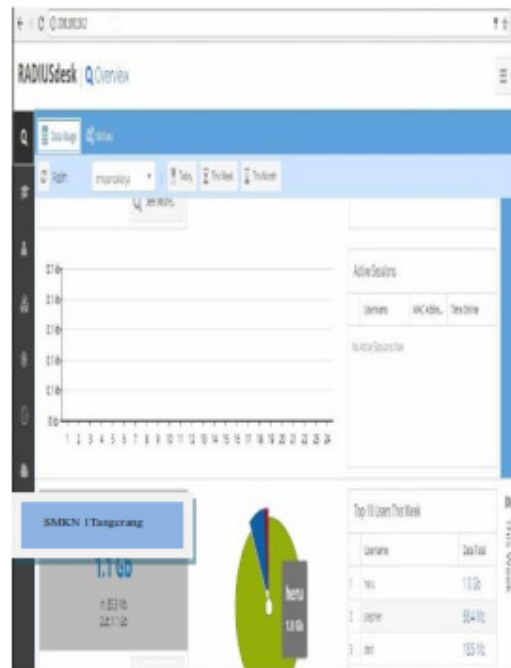

Figure 3. Monitor users and bandwidth usage

IV. CONCLUSIONS

Development and implementation of hotspot networks using the microtower router forinternet access to computers and networksusers at SMK 1 Tangerang. Giving IP is based on the needs of the number of clients atschool. Bandwidth management was made Simple Queue configuration by dividing it into 3 groups, namely: bandwidth for LAB 512 Kbps, Hotspot Teacher 1 Mbps and Hotspot Student 512 Kbps.

Network research and development that can be usedconclusion as follows:

1. This new network design makes the network of SMK 1 Tangerang more optimal because it can be used for SMK 1 Tangerang and for clients on

LAN and WIFI it will not attract bandwidth because it has its own bandwidth.

2. The site blocking system is only done on social networking sites (facebook) with automatic scheduling that is adjusted to the hours of the school, this is done because there is no privacy with education. So students can better use the lessons given by the teacher.

ACKNOWLEDGMENT

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