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**ANALYSIS OF NETWORK LOAD BALANCING IMPLEMENTATION
WITH EQUAL COST MULTI PATH METHOD**

Stefanus Eko Prasetyo, Jimmy Cung
Faculty of Information System, University International Batam
{stefanus@uib.ac.id 1831127.jimmy@uib.edu}

ABSTRACT

Internet Service Providers (ISPs) provide internet services, both for local and international internet connections. The need for internet bandwidth is increasing day by day, sometimes 1 ISP is not enough to support our needs. In some large companies that rely heavily on internet access, of course they have several internet providers for network backups when one ISP goes down. One way of implementing backup and merging of Internet ISP lanes requires load balancing techniques. The method used is Equal Cost Multi Path which is a load balancing technique that uses a per addresspair connection load balancing method. ECMP allows routers to have more than one gateway for a single destination network. This method can be useful to overcome if one ISP is disconnected it will be able to be replaced by a second ISP so that the internet is not immediately lost. The results obtained after implementing ECMP load balancing, companies and users will continue to be connected to the internet, and work will not be interrupted when the main ISP is down.

Keywords: *Internet, Load Balancing, Gateway*

INTRODUCTION

Internet Service Providers (ISPs) provide internet services, both for local and international internet connections. Local connections provide interconnection between ISPs in Indonesia so that they can be connected to each other, while international connections provide bandwidth that can be used to connect to international backbones. Bandwidth is a quantity that indicates how much data can be passed in a connection over a network. The need for internet bandwidth is increasing day by day, so it is often necessary to use internet services from several ISPs at once. A company can add a secondary internet line, if it feels that the primary internet line cannot accommodate the maximum bandwidth usage requirements. The distribution of the use of each internet line can be arranged according to the needs and

characteristics of the user. The use of internet routes can also be maximized by applying load balancing techniques. Load balancing is a method for distributing data traffic workloads in a balanced way through several intermediaries to optimize the use of existing resources so that better performance is obtained. In load balancing there is also the term high availability, which is a method where the load balancer is maintained and can be utilized or take over the processes carried out by other load balancers when needed. Load Balancing is a technique for dividing network load (Traffic) through several available network links to increase throughput, reduce response time and avoid excessive traffic accumulation. Load balancing technique can be applied if the router has several links to reach a destination network. For example, your MikroTik Router is connected to the internet through 2 (two) ISPs. This means that the router has 2 (two) links

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to the internet, and it is also expected that traffic coming from the internet can also pass through the two links in a balanced manner. (Husni et al., 2018). The Equal Cost Multi Path method is the simplest load balancing technique and is more suitable for use on networks with a not too high level of complexity. Load sharing in this method uses a direct comparison setting between the load received by each gateway. The purpose of applying this algorithm is to allow the use of more than one gateway path to be used as an exit interface and to get an even distribution of burdens between each gateway in dividing the existing traffic. This method can also be useful to overcome if one ISP is disconnected it will be able to be replaced by a second ISP so that the internet is not immediately lost. And to be able to perform such a performance, a failover technique is needed, namely the ability of the system to switch paths automatically when one of the lines being used is disconnected. In its use, this algorithm also supports the use of static and dynamic routing. (Jurnal, 2018). The research entitled "Analysis of the application of network load balancing with the equal cost multi path method" is based on several studies that have been carried out previously as follows: Research from (Syaputra & Assegaff, 2017) on the analysis and implementation of load balancing with the NTH method on the network. This study aims to design a network load balancing system on a router by implementing a mikrotik router to combine two ISP services in the problem of congested and slow connections with load balancing so that the dense path will be balanced. The result of this study is that the application of Nth load balancing has provided optimal bandwidth, but load balancing cannot accumulate the bandwidth of the two connections,

because the load balancing technique does not mean $1+1=2$ but $1+1=1+1$. Research from (Haris et al., 2018) about maintaining the stability of the NTH load balancing network with failover techniques. This study aims to ensure the level of stability of the Load Balancing network that is built requires a network recovery process. Therefore we need a technique that is used as a recovery to the network using the Failover technique. The result of this research is that the network uses the NDLC method, there are several conclusions that can be drawn from the implementation of nth load balancing with failover techniques, namely: (1). Nth Load Balancing with Failover technique has been successfully implemented with the addition of 1 (one) ISP with a balanced distribution of traffic load on ISP 1 and ISP 2 as well as network recovery when one of 2 (two). Research from (Januar Al Amien & Doni Winarso, 2019) on the analysis of improving FTP server performance using load balancing on containers. This study aims to deal with the problem of performance load on the FTP server against requests that are too heavy (overload). So to overcome this, a load balancing system is used. Load balancing is a method to increase performance while reducing the performance load on the FTP server. The result of this research is the application of load balancing can divert a dead service to another service, so that the data transmission process is not interrupted due to a dead service. Research from (Saputra et al., 2020) on the implementation of service infrastructure in cloud computing using the load balancing method. This study aims to deal with the increasing number of web server users, thus making the web server performance slow. So that the load balancing method is carried out to deal with existing problems. The result of this

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research is the performance of the web server becomes more stable when the network is busy.

Research from (Riskiono & Darwis, 2020) on the role of load balancing in improving web server performance in a cloud environment. This study aims to model, design, test and evaluate load balancing methods that aim to improve the Quality of Service (QoS) of services in dealing with high demand in maintaining the availability of services on web servers in a cloud computing environment. So that parameters such as response time can be maximized. Besides that, to deal with overload when the number of service access increases, the application of a number of servers can be an option to overcome this. A collection of a number of servers can also be called a server cluster. So that with the implementation of the server cluster, the availability of applications and the reliability of the system can be increased. The results of this study are testing the application of load balancing, the response time is 1.62 ms smaller than without load balancing. This condition states that the load sharing can be distributed evenly on each web server which affects the response time given by the server. The load balancing server in this study is single so that an increase in the number of load balancing servers and the application of a fault tolerance model is very necessary for the availability of better systems and services.

PROPOSED INNOVATION

From what has been described previously, this research, entitled “analysis of the application of network load balancing with the equal cost multipath method”, is expected to overcome internet and server traffic problems, improve quality of service and optimal bandwidth, and minimize server overload.

METHODS

In this design load balancing, researchers will use the NDLC method.

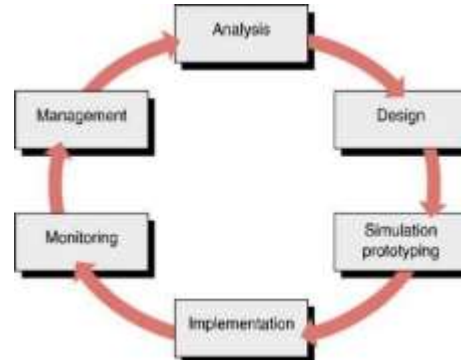


Figure 1. NDLC method

System development means compiling a new system to replace the old system as a whole or improve the existing system. Based on the reference definition of a number of existing system development models, in this study, the author uses the NDLC (Network Development Life Cycle) system development method. NDLC is a model that defines the design or development process cycle of a computer network system. NDLC has elements that define a specific phase, stage, step or process mechanism. NDLC defines a process cycle in the form of phases or stages of the mechanism of the mechanism needed in a design process for the development or development of a computer network system, related to this research, the implementation of each stage of NDLC is as follows:

A. Analysis

In this initial stage, a needs analysis is carried out, an analysis of problems that arise, an analysis of user desires, and an analysis of the current network topology. The methods commonly used at this stage include:

a) Interviews were conducted with related parties involving the upper management structure to the lower level/operators in order to obtain concrete and complete data. In the case of Computer Engineering, usually also

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brainstorming from the vendor for the solutions offered from the vendor because each has different characteristics.

b) Direct field survey, at the analysis stage, a direct field survey is usually carried out to get real results and a complete picture before entering the design stage.

c) Examining any data obtained from the previous data, it is necessary to analyze the data to enter the next stage. As for what can be a guide in finding data at this stage of analysis are:

1. User/people: number of users, activities that are often carried out,
2. Media Hardware and Software: existing equipment, network status, availability of data that can be accessed from the equipment, software applications used.
3. Data: number of customers, number of system inventory, existing security systems in securing data.
4. Network: network configuration, network traffic volume, protocols, current network monitoring, expectations and future development plans.

B. Design

From the data obtained previously, this Design stage will create a design drawing of the interconnection network topology to be built, it is hoped that this image will provide a complete picture of the existing needs. The design can be in the form of a topology structure design, data access design, cabling layout design, configuration design, and so on which will provide a clear picture of the project to be built.

C. Simulation Prototyping

In this prototype simulation stage, it aims to see the initial performance of the network to be built and as a consideration before the network will actually be implemented. Usually this stage describes a simulation or a

trial of the application network is carried out.

D. Implementation

In the implementation the author will apply everything that has been planned and designed previously. Implementation is a very decisive stage of the success / failure of the project to be built. At this implementation stage the author will implement the Winbox application, bandwidth management, proxy settings, firewalls, routing, DHCP Client, NAT and network management tools. which is on the Mikrotik RouterOS.

E. Monitoring

After the implementation of the monitoring stage is an important stage, so that the computer network and communication can run according to the wishes and initial goals of the user in the early stages of analysis, it is necessary to carry out monitoring activities.

Monitoring can be in the form of making observations on:

1. Monitoring the traffic running on the network is appropriate.
2. View the active connections on the network.
3. View the results of bandwidth measurements on the entire network.
4. Evaluate Bandwidth and network settings.

F. Management

At this management stage, management steps will be carried out so that the system that has been built can run as expected. The steps that need to be taken are: Distribution of bandwidth according to the needs of each user, perform configuration backups, so that at any time something happens that can damage the network, we can restore it to its original configuration.

ANALYSIS AND DISCUSSION

A. Analysis

The analysis stage is the earliest stage carried out in this research, this stage requires an analysis of the hardware and software requirements needed in developing computer networks. The hardware needed is two internet service providers, a Mikrotik Router, a PC that is used as a client, while the software needed in this study is a Windows

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operating system, MikroTik Operating System, WinBox 3.1, CMD, Browser.

B. Design

The Design stage is carried out to explain the workflow of the system and network that will be made to make it easier to configure. The designs that have been made include:

1. Physical Network Topology Design

The following physical topology design describes how the topology can be implemented in an agency/company. The physical topology design of the proposed network is shown in Figure 1.

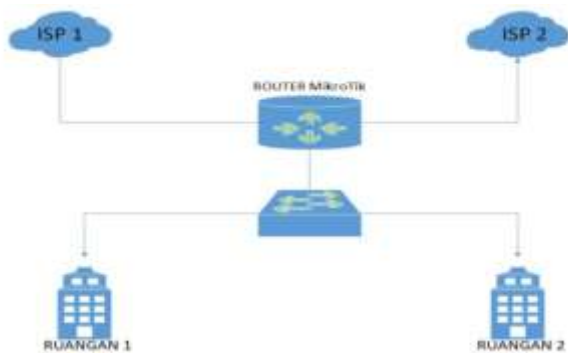


Figure 1. Physical Network Topology

2. Network Logic Topology Design

The logic topology design describes the things that are considered in the configuration during implementation. The design of the proposed network logic topology is shown in Figure 2.

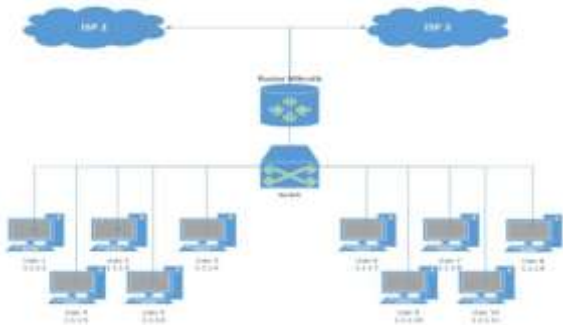


Figure 2. Network Logic Topology

3. Design UseCase Diagram Use Case diagrams that explain what administrators can do in using the system are shown in Figure 3.

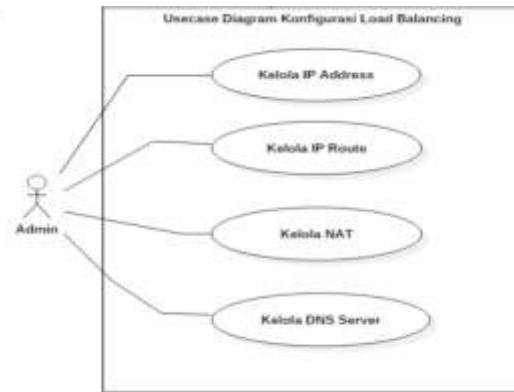


Figure 3. Usecase Diagram Web Load Balancing Configuration

C. Implementation

1. Network Test

Network testing that the author does is to use the ping test. Where when the ping test is carried out it will be seen whether the load balancing that is applied is running well or there are still problems that must be fixed. Initial testing was carried out to find out that before load balancing was implemented the two ISPs did not back up each other.

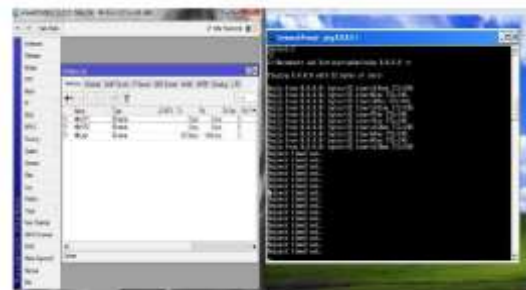


Figure 1. Initial Network

From the picture above, it can be seen that before there was load balancing, although there were two active ISPs, there were still requests timed out, this indicates that there is no path division so that only one path is read, and of course for the above observations, the implementation of load balancing is indeed needed so that it is able to evenly share the load between the first ISP and the second ISP and can optimize the available ISP resources. In the final network test, it is described how network testing is carried out when tested with connection tests and also shown how the effect on the network after load balancing is done. Basically, this ECMP technique is to configure two gateways between one network

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and another so that both networks can connect and share the load evenly. In addition to dividing the load evenly, the reason why you take load balancing with the equal cost multi path method is that you can share the network load based on the speed comparison between the two ISPs, so you can not only share but also choose which ISP to prioritize, this is based on the speed of each ISP. so as to maximize the available resources. Furthermore, when this technique is implemented, it can be seen whether it runs well and smoothly or whether there are obstacles that hinder the implementation of this load balancing. Below is figure 2 of the final network test where the first ISP is simulated to experience a connection drop.

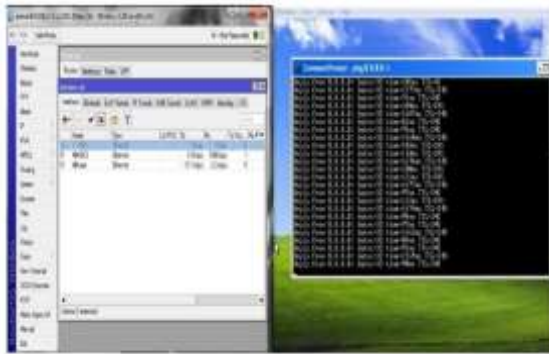


Figure 2. ISP Down

The picture above was taken when the condition of one ISP was turned off or in reality it was down, it can be seen that the connection is still running well. To be further simulated if the two ISP lines are turned off or down.

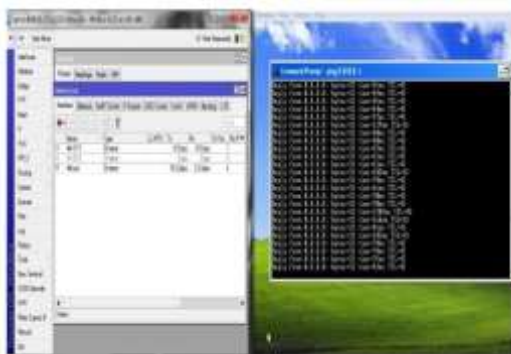


Figure 3. ISP 2 Down

It can be seen that the connection is still running fine when the two ISPs are turned off

or down, this means that load balancing is running well. And it can be proven from the results of the ping test, with a reply from this, it indicates that there are no problems or interruptions in the connection. Now is what if both ISPs are down or disconnected, below are the results of the ping test that is carried out if both ISPs are disconnected.

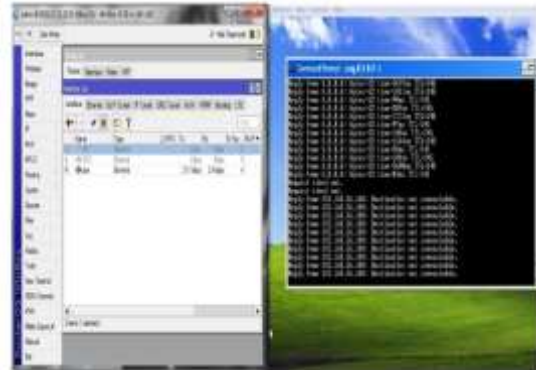


Figure 4. Both ISPs Down

It can be seen that when the two ISPs are down or disconnected automatically the connection is also lost, this is evidenced by the destination host unreachable message.

D. Management

The management stage is carried out when the implementation or simulation has been implemented so that the network and system can run well and optimally.

Management that can be done includes:

1. MikroTik User and Password Management User and password management performed to enter the MikroTiK router configuration is shown in Figure 1.

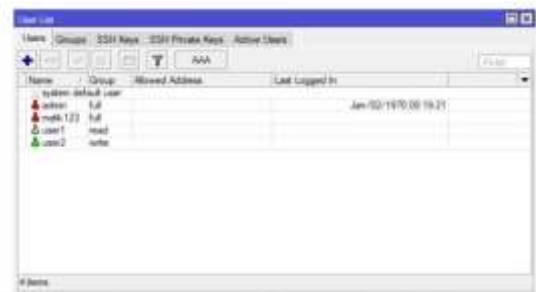


Figure 1. MikroTik User and Password Management

2. MikroTik Client Management MikroTik client management is carried out to see who is connected through the MikroTik network as shown in Figure 2.

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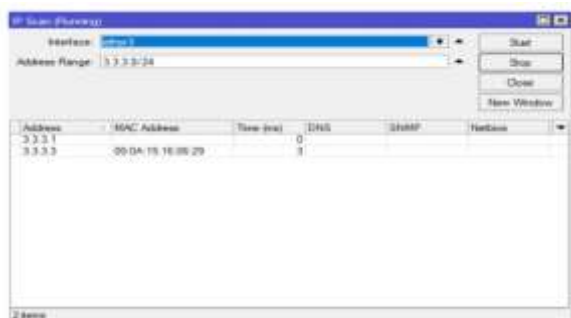


Figure 2. Mikrotik Client Management

3. Backup of the proxy configuration is very important to do, if at any time the configuration on the proxy has a problem or error, the configuration of the proxy can be reset and restored.

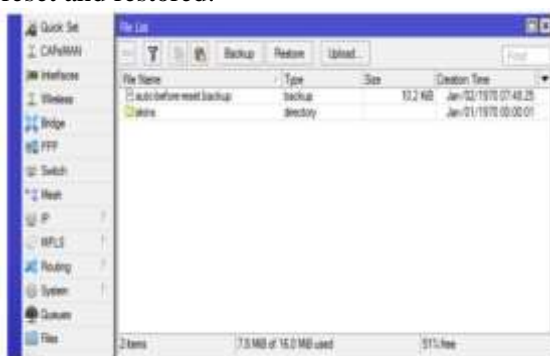


Figure 3. Backup Mikrotik data

LIMITATIONS

The limitations of this research are:

1. load balancing implemented using mikrotik devices.
2. more infrastructure development costs. because it takes more than one link and one server/service provider.
3. If the main server has problems then other servers under it or virtual will have problems.

FUTURE WORK

A load balancing system in the future will be very useful for companies to help servers transfer data efficiently, and optimize the use of resource delivery applications so as to avoid server overloads and unstable internet connections.

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