



Network Design Using Proxy-Based BGP (Border Gateway Protocol) Routing

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Abstract: Today, information technology is increasingly advanced and developing rapidly, providing many benefits and conveniences in various fields. Mikrotik improves the stability of the internet network. In addition, XYZ Bengkulu City uses the internet network. The routing configuration on the router used changes from static routing done manually to dynamic routing BGP (Border Gateway Protocol). BGP is a type of routing protocol used to transmit information between autonomous systems. The purpose of the researcher is to design and build an internet network for XYZ Bengkulu City using BGP so that the move from the main line to the backup line is carried out automatically with BGP Route. Continued by checking the quality of both lines using the QoS (Quality of Service) method, some of the QoS parameters used as a reference are throughput, delay, jitter and packet loss, by following the QoS standard from TIPPHON. So in this study, we conducted tests and discussions that focused more on how routing using BGP could work well, automatically backing up internet connections and analyzing QoS as a result of the research that BGP routing works well and has an optimal internet connection for operational use of XYZ Bengkulu City

Keywords : *Networking, Routing, Microtics, BGP, Qos Testing*

Introduction

Sekolah Pendidikan Negeri Bengkulu (XYZ) is a vocational school specialising in design and production, dance, art, accounting and finance. XYZ Bengkulu City is located at Jln. Kapuas No.06 RT.14/RW.04, Padang Harapan, Gading Chempaka, Bengkulu 38225. As seen earlier, XYZ has a computer system that is connected to the Internet. The website is managed by the school administration and supports teaching and learning activities. According to the head of school administration, basic information obtained from XYZ shows that the use of the Internet in this school is not well utilised by the school administration, teachers, and students (Abdelfattah, 2021; Georgescu, 2021; Pan, 2022).

The Internet is a communication channel that allows Internet technology to communicate with other devices around the world. There are many ways for websites to connect to the Internet (Dudziak, 2020; Langemeyer, 2020; Wu, 2020). Packets that need to

be sent to the destination cannot be sent through all available channels. A selective approach is required. The term routing refers to the process of route selection.

By easily configuring Mikrotik routers using a simple GUI (Graphical User Interface), you can find devices that can be used as servers instead of Mikrotik routers. Mikrotik is designed to provide an easy solution to solve problems related to managing computer networks, such as the creation and construction of small and complex computer systems (Sashi, 2019; Tourani, 2018; Zhong, 2020). One of Mikrotik's features is its ability to control each user's access to the Internet. There are two types of signal management system configurations (routing): static routing and dynamic routing. Static directories are used to manually determine routes on computer networks. The purpose of static routing is to avoid errors when sending packets to destination routes associated with different routes. (Giuliono and Rossianni, 2022).

This website uses advanced routing technology that can be configured as needed. BGP (Border Gateway Protocol) is a gateway between autonomous systems used in dynamic management (Chen, 2018; Panja, 2018). According to RFC 4271, BGP-4 (Boundary Gateway Network) is a routing protocol between autonomous systems that can exchange data or information with the network covered by the BGP system itself. In addition, BGP-4 can retrieve information recorded by autonomous systems (AS). One of the main purposes of the BGP communication system is to exchange information available on the network. ISPs use the Border Gateway Protocol (BGP). BGP is also used between ISPs and their wholesale customers to exchange routing information. (Ernavathy and Endravan, 2018).

In situations where it is very difficult to go through the Internet with multiple connection paths, the BGP method can be used in this study to solve the problem. Therefore, the BGP routing technique (rule-based routing protocol) is suitable for routing packet traffic based on its characteristics so that the packet traffic controller can determine the signal path to be sent to the destination. One of the disadvantages of the BGP protocol is they can be attacked by an attack called BGP hijacking or prefix hijacking. (Pranaya1, undated).

Based on the problems described by the authors in this article, the authors discovered the BGP management method in Mikrotik, which leads to improved routing management, improved network security with the BGP method, and access to quality services to support various styles of training and administrative activities in schools. From the description of these research problems and successes, we try to approach the topic entitled "Analysis of the Mikrotik-Based BGP (Border Gateway Protocol) Routing Method in Internet Network Management". It aims to stabilise network throughput, reduce data transmission delays, and provide resilience to changes in network demand.

Methodology

1. Problem Analysis

When exploring the work environment, the author found several problems, especially the network at XYZ Bengkulu city. These problems include:

- a. On the website of XYZ Bengkulu City there is only one gate or channel.
- b. Downtime depends on how the ISP handles outages.

- c. Downtime disrupts the student learning process and staff management.

Since the internet at XYZ Bengkulu City still uses one channel without an adequate backup channel, the impact of the outage will affect school activities.

2. Network Requirements Analysis

To implement BGP management in the use of the Internet at XYZ Bengkulu City, among other things, IP addresses are needed, which include public and private IP addresses.

For roads and radios, this is one of the new requirements in the construction of a new network at XYZ Bengkulu City.

3. Information Needs Analysis

1. Current topology data from the old network will be migrated to the new network in the future.
2. Current information about local IP addresses, including applications that can be used with them when moving from the old network to the new network.
3. Information about currently available public IP addresses, including how they can be used for any purpose; This data changes when moving from the old site to the new site.

4. Functional Requirements Analysis

1. Normal wake-up. The default route to this PoP (point of presence) is bidirectional, consisting of a primary link and a backup link in case BGP error routing is required. Defaults for this method:
 - A. link to game
Optical paths are used as data paths due to their higher bandwidth and immunity to interference from previous paths...
 - B. Archive link
In addition to saving money, wireless return links are used as data transfer devices because they follow a different PoP return path than forward links.
2. Border Gateway Protocol (BGP) routes and BGP route functionality will be used for failover in the future; BGP then determines which link to use as the main link and which link to use as the loopback link.
3. One of the most important functions used after routing is route filtering, which filters IP addresses and selects other routes to route when BGP routing is active.

5. Device Requirement Analysis

1. Hardware Analysis

Marketing plays an important role in improving web performance. Website performance increases as hardware specifications increase. The following technical specifications are used by XYZ Bengkulu City for its BGP network.

1. Driver is damaged: Mikrotik RB 3011UiAS
2. Wireless Radio: PowerBeam 5AC Gen2

2. Software Analysis

The software required to implement BGP over the Internet includes:

1. Router OS or Mikrotik OS version 6.45.6.
2. Winbox as a tool to access Mikrotik software.
3. Web browser to download radio stations.

6. Analysis of the current network

The topic of online data discussion this time is online data created at XYZ Bengkulu city. To find out more about online business activities at XYZ Bengkulu City, the following are the results of the analysis:

1. The website of XYZ Kota Bengkulu only has normal channels and is used for school management purposes.
2. All administrative functions and some Internet services are performed on the core Internet network.
3. Some local servers require a public IP address.
4. Some areas, such as LAN Management, Student Wi-Fi, and Computer Lab Wi-Fi, use private IP addresses.
5. There is no difference between the current ISP network devices and the operator of XYZ Bengkulu City.

7. Network Implementation Design

Before using the new network implementation with multiple addresses such as IP addresses and failover using BGP itself, the network design has been completed.

1. IP Address Design

The IP address scheme here is the IP address used to implement denial as shown in Table 3.1.

Table 3.1. List of IP addresses and their functions

IP Address	Secret	Working
10.242.252,26	255 255 255 252	Basic style of point-to-point IP gateway
10.242.252,30	255 255 255 252	Point-to-point IP gateway support Related
10.255.254.155		IP circle
SMKN Public IP Address 5 Kota Bengkulu	255 255 255 248	Public IP for web application and server of XYZ Kota Bengkulu..
192.168.100.1	255.255.255.0	Private IP address for DHCP bypass router

2. Failover Design Using BGP

XYZ Bengkulu City network is used to design routing filters, BGP sessions and BGP peers, etc. when building a network using BGP.

1. Routing Filter

The routing filter design will be applied to the router of XYZ Bengkulu City.

The routing list filter is applied to filter allowed IP addresses, i.e. addresses purchased from PoP routers and IP addresses or their prefixes not displayed to PoP routers.

2. BGP Instance

Table 3.3 shows an example of BGP configuration on the path of XYZ in Bengkulu city.

Table 3.3. Routing Instance Table Router

Name	AS	Router ID	Checked
FAOV	65155	10.255.254.155	Redistribute Connected

The BGP instance structure in Table 3.3 is used to identify the mobile operator of XYZ Bengkulu City.

3. BGP Peer

Table 3.4 shows the BGP dual diagram of XYZ in Bengkulu.

Table 3.4. BGP Peer Router Table

Name	Instance	Remote Address	Remote AS	In Filter	Out Filter	Def. Originate
MAINLINK	FAOV	10.242.252.25	65112	Default Only	Distribusi	Never
BACKUP	FAOV	10.242.252.29	65121	Default Only 99	Distribusi 99	Never

Result and Discussion

1. Network Implementation

1.1 IP Address Implementation

Below are the results of IP Address enforcement based on IP Address configuration data with Winbox.

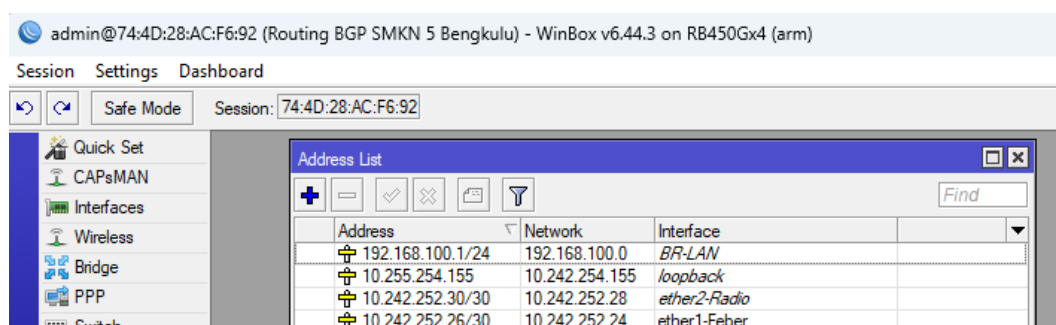


Figure 1. Implementation of Failover Router IP Address

Point-to-point IP addresses for outgoing connections and connections to the /30 netmask are only used when necessary; IP loopback is available and ensures that the failover router can ping the same IP address regardless of the gateway used.

1.2. Failover Implementation using BGP

1. Routing Filter Implementation

The results of the implementation of the based routing filter design are shown in Figure 2. Below.

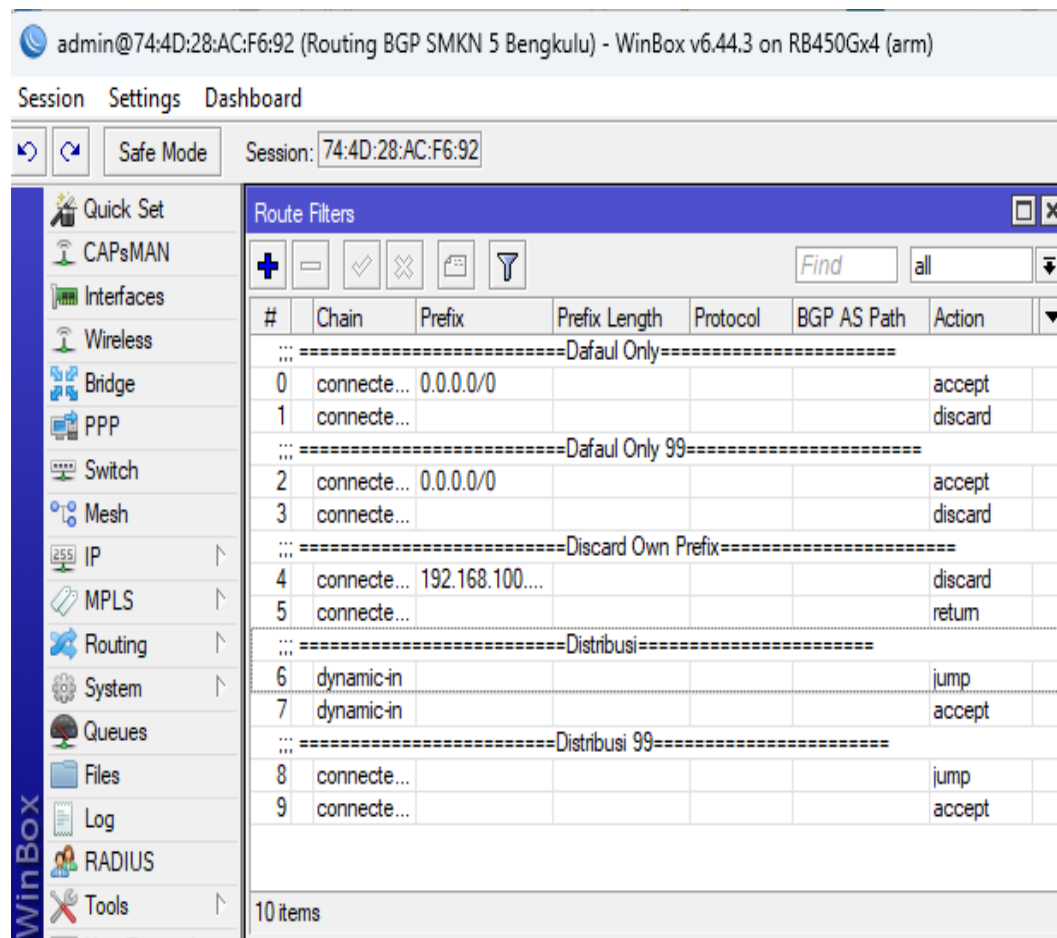


Figure 2. Routing Filter on Router

The route filters use the priority in the failover function to perform IP filtering. Firstly, they accept Standard Only as the default exit rule for the first bet and Standard 99 Only as the default exit rule for the second bet. The second method is to use mapping and set 99 rules to change the IP address of the failover router to the PoP router.

Although there are more rules for PoP routers, prefix denial itself is a new rule that ensures that IP addresses that should not be published by the principal should not be published. This is a barrier to prevent flooding.

2. Implementation of BGP Instance

The results of implementing BGP on the scheme are shown in Figure 3. Below.

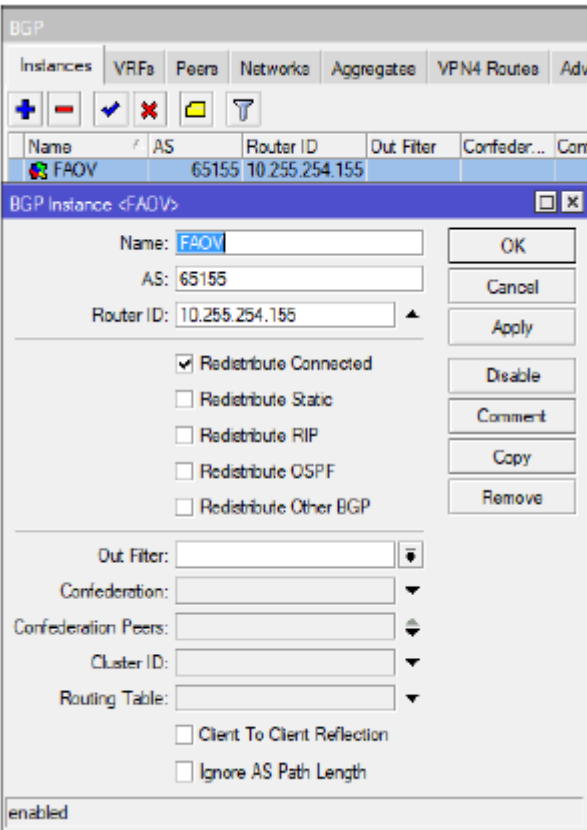


Figure 3. BGP point on the router

To assign the AS address and router ID on each router, the BGP pattern is used. Therefore, redistribution is used to deploy connected links or routes. Since AS 65155 is part of the ISP's network infrastructure, it is used.

3. BGP Peer Implementation

The results of the BGP Peer implementation on the fault-tolerant router as configured in Figure 4 are shown. Below.

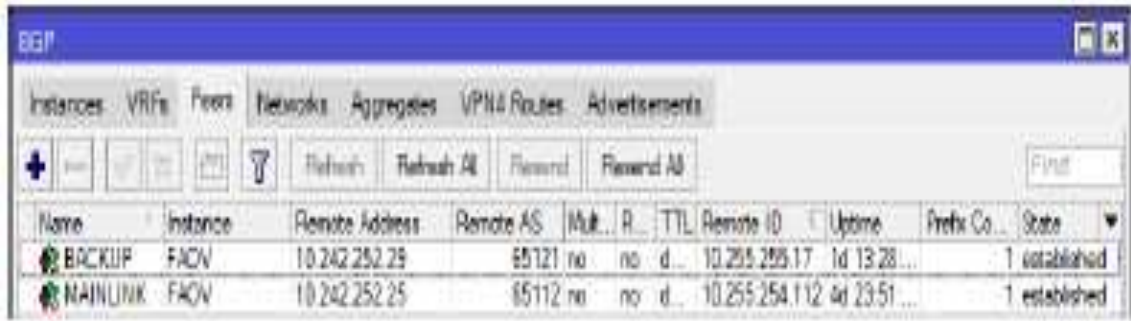


Figure 4. BGP Peer on Router

The primary link and backup link are established with two BGP peers and divided into separate remote addresses in the United States. If the BGP peer of the primary link is not created, it is assumed that the backup link can perform automatic backup.

Conclusion

From the results of the discussion of research on the application of Data Mining Using Apriori Algorithm as follows: (1) Building a network using BGP routing and failover will reduce network disruptions at XYZ Bengkulu City. (2) Due to the failure of the network gateway to manage and resolve BGP, it will reduce the network monitoring efforts of the network administrator of XYZ Bengkulu City. (3) With the creation of a network using BGP routing and failover, no disruptions occur, thus facilitating the administration and learning process at XYZ Bengkulu City. (4) Both feedback methods are good and suitable for use in the teaching and learning process and management at XYZ Kota Bengkulu.

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