

# Implementation of Load Balancing With PCC Method And Failover Using Mikrotik At PT. Maxpower Indonesia

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**Abstract** – In connecting to a single Internet Service Provider (ISP), one must consider the possibility of network congestion due to high traffic as well as potential disruptions in the internet connection. Load Balancing Per Connection Classifier (PCC) is a method used in combining two ISP services. In supporting day-to-day operational activities, a reliable internet connection is crucial for any company. Therefore, it is also necessary to have an internet connection that remains standby without interruption when there are disruptions in the ISP. This paper discusses the merging of two internet services and the addition of failover techniques. In the first test, a load test was carried out with 1 ISP service. The second test was carried out using two ISP services with the PCC method in high internet traffic conditions. By using the ISP and PCC method, traffic can be reduced and charged to both ISPs so that the network is not burdened by just one ISP. In the second test, it can also be proven that the use of two ISP services with failover techniques is much better when a problem occurs at one of the ISPs, thereby reducing the company's operational impact.

**Keywords** – ISP, Load Balancing, PCC, Failover, Bandwidth.

## I. INTRODUCTION

Current developments in information technology greatly influence company business patterns and strategies. Many companies are trying to improve their performance to be superior in business competition. One way is to utilize the internet, with the clear intention of connecting hosts on different networks, or perhaps geographically separated in large areas [1]. The rapid development of computer networks and the internet as an information medium must of course have good connection quality. The performance of a network is very much needed at PT. Maxpower Indonesia is very dependent on Internet Service Providers (ISP) to support the company's business processes. Currently PT. Maxpower Indonesia still uses one CBN internet provider with a bandwidth of 100 Mbps, but when there are many users connecting to the internet and the network server becomes very burdened which can hamper ongoing business processes. Research [2] states that when there are many requests from users, network devices will be burdened because they must serve many processes for user requests.

Other problems occur when there are problems with ISP services such as fiber cuts, mass disruptions which can hinder work because they require internet access. Research [3] states that using two or more ISP services with PCC load balancing and failover methods is necessary to prevent connection failure when only using one internet service. Because it will be implemented using several links, the load balancing technique will be accompanied by a failover technique. A technique called load balancing, namely distributing a load, and setting the client connection path to a service on the server by utilizing a connection distribution method using the Per Connection Classifier (PCC) method [4]. Several previous studies have focused on implementing load balancing for networks aimed at users. Research [5] aims to find out and use optimal ways to distribute network workload to web servers. Research [6] aims to try a solution if one of the two internet lines is down, is the other line

active and if both lines are active then they can run together. Then research [7] aims to compare the performance of Mikrotik routerOS with OpenWRT using load balancing techniques. To compare performance, a Quality of Service (QoS) analysis is carried out using throughput, packet loss and delay parameters, which will then determine the service category using the Telecommunications and Internet Protocol Harmonization Over Network (TIPHON) standard. The suggested resolutions entail enabling VPN on MikroTik and bolstering the capacity of database storage [8]. MikroTik, a software that serves as a router, has been widely utilized by various organizations and institutions to provide network access services [9].

Research [10] aims to design a load balancing scheme using the per connection classifier (PCC) method to overcome the problem of traffic density on the network. The research results show that the application of the load balancing technique on the Mikrotik router using the PCC method can separate internet connections via two available ISP lines so that it can overcome the problem of traffic buildup on one of the ISP links to reduce latency and improve the performance of the existing network. Research [11] focuses on network configuration methods to maximize internet bandwidth usage for all users. Quality of Service is used to view network traffic performance as indicated by the parameter values of delay, throughput, and packet loss. The results of testing and research carried out before and after using PCC load balancing, the delay value decreased from 180.26 ms to 148.36 ms and throughput increased from 1.76% to 2.03%, then packet loss decreased from 25, 37% to 18.59% according to TIPHON standardization.

## II. RESEARCH METHODOLOGY

The method used in this research is PPDIIO [12]. This method is a method implemented by Cisco which is designed to support growing networks [13]. This method consists of six closely related phases consisting of the



Prepare, Plan, Design, Implement, Operate and Optimize stages [14]. The primary benefit of PPDIIO is reducing TCO (total cost of ownership). PPDIIO also enhances network availability by employing a robust network operation validation approach [15].

**Preparation Stages**

At this stage, data collection was carried out during the research. The author conducted research for three months at PT. Maxpower Indonesia to collect data related to running computer networks.

**Plan Stages**

This phase begins with identifying the needs of the system to be developed. Information was gathered through research and interviews. Next, the author analyzes the advantages and disadvantages of computer networks to determine the parts that need to be optimized to improve the network's performance.

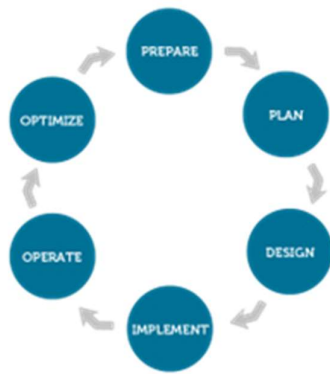


Fig. 1 PPDIIO Research Methods

**Design Stages**

In this step, the proposal network design is carried out. This network design plan is a complete detailed picture, meets relevant business and technical requirements, and incorporates guidelines to ensure the availability, reliability, security, growth capabilities, and performance required throughout the implementation process.

**Implementation Stages**

At this stage the implementation is carried out by applying the Load Balancing method with the Per Connection Classifier to equalize the load on the two ISPs on the prepared proxy devices.

**Operate Stages**

At this stage, after implementing Load Balancing the author applies the failover technique. This technique is used if one of the ISPs experiences problems, then the proxy will automatically divert traffic to a connection that is still active.

**Optimize Stages**

At the optimization stage, this is done by checking again on devices that have been configured and implementing load balancing and failover techniques to ensure that optimal network performance and high service availability are maintained.

**III. RESULTS AND DISCUSSION**

Based on research conducted at PT. Maxpower Indonesia uses one CBN internet provider with a bandwidth of 100 Mbps. The computer network used is a WAN type. A system consisting of computers, software and other network devices that work together to achieve a common goal. In order to achieve these goals, each part of a computer network requests and provides services. The party who requests or receives services is called the client and the one who provides or sends the service is called the server. This architecture is called client-server and is used in almost all computer network applications. The network topology used at PT. Maxpower Indonesia is a star topology, which uses several switches and two routers to connect computer networks. Especially for networks in branch offices or remote areas of PT. Maxpower Indonesia uses routers and Multi Protocol Label Switching (MPLS) services to form a WAN network. The switch used for computer networks at PT. Maxpower Indonesia is a computer network component that has many ports so that it will form a LAN computer network in a star topology.

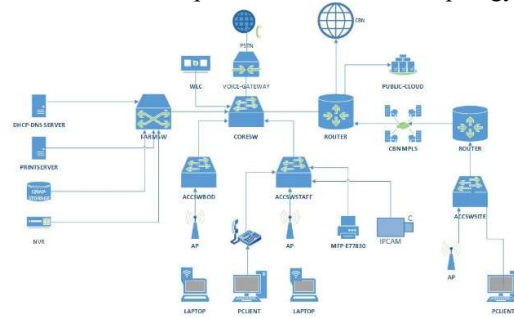


Fig. 2 Running Network Scheme

From the schematic in Figure 2, the connection between computers is centered on the core switch which is connected to another access switch. The core switch is in the head office server room, while the DHCP, DNS, Wireless Controller (WLC), Printserver and Storage server servers are connected via the switch farm. To access public cloud resources using a router using azure tunneling or azure site-to-site Virtual Private Network (VPN). This is a model where the local network relates to a virtual network in azure using VPN protocol. The connection allows secure and encrypted traffic between the two networks.

The following IP addresses are used to uniquely identify each device on a network, allowing these devices to exchange data with each other over the internet or local network and to communicate with each other within the network.

IP configuration is a crucial part of network management because it ensures that devices on the network have the right addresses and are properly connected to communicate with each other.

Table 1. Network IP Address

No	Device Name	IP Address	Subnet Mask
1	Mikrotik CCR	192.168.10.1	/24
2	Cisco Core sw	192.168.19.20	/24



3	Cisco Farm sw	192.168.19.21	/24
4	Cisco Access	192.168.19.22	/24
5	DHCP Server	192.168.10.142	/24
6	Cisco WLC	192.168.10.18	/24
7	Cisco AP	192.168.10.0	/24
8	Cisco VG	192.168.30.200	/24
9	Cisco CM	192.168.30.5	/24
10	IP Phone	192.168.30.0	/24
11	BOD Client	192.168.15.0	/24
12	Staff Client	192.168.10.0	/23

While observing PT. Maxpower Indonesia, the author found several problems that often occur. One of them is when there is a spike in traffic during rush hour before noon. The problem that often arises is internet connection problems which cause downtime.

### 3.1 Proposed Network Design

The topology proposed for PT Maxpower Indonesia is no different from the previous topology because it still uses a star topology. The following is the proposed network scheme at PT. Maxpower Indonesia has been updated using two ISPs for load balancing and failover.

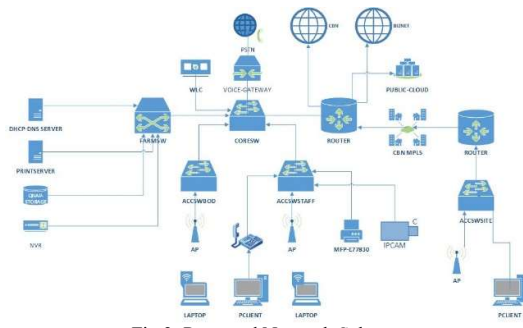


Fig 3. Proposed Network Scheme

In figure 3 there is the addition of one Biznet ISP service which will be combined with the load balancing method, namely ISP2. This load balancing will distribute internet traffic evenly between the two ISPs. This can reduce the load on one ISP and ensure more stable and guaranteed internet availability.

Apart from that, using two ISPs, if one ISP experiences interference or downtime, the internet connection can remain active through the other ISP. This creates a higher level of redundancy and minimizes the risk of losing connectivity.

### 3.2 Implementation

The implementation is carried out through the Load Balancing method with PCC separating traffic based on certain criteria such as IP addresses, ports, or protocols used in the connection. This allows the system to distribute the traffic load evenly across the various available paths or connections. PCC is a load balancing method that can be applied on MikroTik to divide the traffic load efficiently.

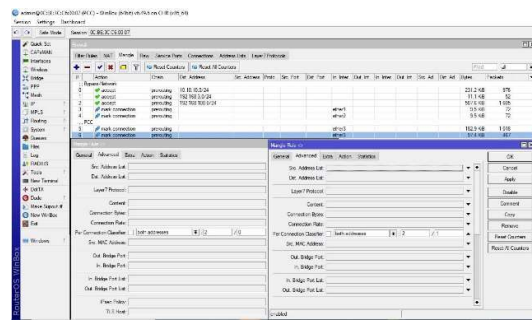


Fig 4. PCC Mangle Rules Settings

Furthermore, combining load balancing with failover techniques, this method is used to maintain system availability by automatically switching to backup resources when a failure occurs at one of the ISPs. This technique is very important to maintain smooth operations, especially in network and system environments that require high availability. Redundancy with failover techniques can be a solution when downtime occurs on nodes in the network.

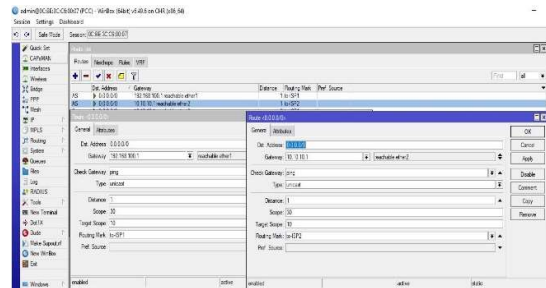


Fig 5. Failover Routing Settings

### 3.3 Testing the Proposed Network

This test is carried out load testing when the client is using Microsoft Teams and carrying out other activities using ISP1 and ISP2 running or load balancing with PCC.

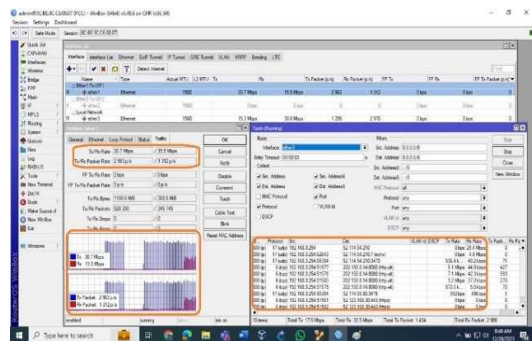


Fig 6. PCC Load Test Results on Two ISPs

From the monitoring results, testing on the ISP1 interface shows that traffic is shared with ISP2 when using the internet and making Teams calls. From figure 6 it can also be seen that sending traffic passes through ISP1 and receiving traffic passes through ISP2. So, it can be explained that the client traffic load can pass through the two ISPs that use the PCC load balancing method.



#### IV. CONCLUSION

From the research findings and discussions outlined earlier, the author can conclude that the use of two ISPs in load balancing methods in computer networks can effectively distribute data traffic evenly among multiple paths or connections, thus preventing network overload during high traffic periods. The implementation of the PCC method automatically divides traffic from both ISPs to ensure balanced utilization.

Load balancing with PCC and failover techniques has been proven to enhance network availability, optimize resource utilization, and ensure continuous data flow even in the event of disruptions in one path or ISP. PCC load balancing and failover techniques can be relied upon to support the business processes of PT. Maxpower Indonesia.

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