UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty Information and Communication Technology

ENHANCEMENT OF TRAFFIC COLLISION AVOIDANCE USINGTOKEN BUCKET ALGORITHM

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ENHANCEMENT OF TRAFFIC COLLISION AVOIDANCE USING TOKEN BUCKET ALGORITHM

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A thesis submitted
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DECLARATION

I declare that this project entitled “Enhancement of Traffic Collision Avoidance using Token Bucket Algorithm” is the result of my own research except as cited in the references. The project “Enhancement of Traffic Collision Avoidance using Token Bucket Algorithm” has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ……..

Name : ……..

Date : ……..……

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Computer Science in Internetworking Technology.

Signature : ……..

Supervisor Name : ……..

Date : ……..……

DEDICATION

To my beloved mother and father

(Mr. Mat Nawi Bin Jusoh & Mdm Mas Binti Awang)

ABSTRACT

Traffic collision is one of the problems that occur in the wired network. In order to provide a high performance network, QoS is required. Traffic shaping is one of the tools to provide QoS in the network traffic. However, implement the basic mechanism of traffic shaping cannot solve the issued. In this project, the optimal size of bucket in Token Bucket Algorithm is used as one of the techniques in traffic shaping. The variables of this algorithm is modified in order to offer the effective proposed token bucket size that can be used in wired network. Then, this project will be tested using OPNET modeler.

ABSTRAK

Perlanggaran trafik adalah salah satu masalah yang berlaku dalam rangkaian berwayar. Dalam usaha untuk menyediakan rangkaian berprestasi tinggi, QoS diperlukan. Membentuk Trafik adalah salah satu alat untuk menyediakan QoS dalam trafik rangkaian. Walau bagaimanapun, melaksana mekanisme asas membentuk trafik tidak boleh menyelesaikan masaalah perlanggaran trafik. Dalam projek ini, Token Bucket Algoritma digunakan sebagai salah satu teknik dalam membentuk trafik. Pembolehubah algoritma ini diubah suai untuk menawarkan algoritma berkesan yang boleh digunakan dalam rangkaian berwayar. Kemudian, projek ini akan diuji menggunakan OPNET modeler.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In this chapter, provide the overview to the rest of the research by describing the contents of this project. It includes the project background, research problem, research question, research objectives, research scope, project significant and expected output of this project.

1.2 Project Background

From the internet lives statistics source, the number of users that are connected to the internet worldwide for year 2015 is reaching to the 3 billion people. Then, from the ranking numbers of users based on country, Malaysia is at ranking number 37 out of 198 countries over the world (InternetLiveStats, 2015). This growth is predicted to increase year by year. Therefore, internet will become the most important medium for people worldwide to communicate or shared information for each other in a light speed in various kinds of devices that are developed for help human being.

Network traffic nowadays becomes the busiest traffic especially during the busy-hour. Users send or request various kind of data from different places. When the users do this task at the same times, it can impact the productivity of the business network's users, causing the unstable connections and slow speeds. Once this happen, the user's or worker's performance in completing their job will affect. And this also will affect the company's

business (Evolven, 2014). Effect from the busy network can cause network collision in network traffic.

In order to solve traffic problem, network traffic must be managed and shaped the specific speed to the connected clients to optimize the internet usage. To shape the network traffic, Token Bucket algorithm will be implemented in this project. This algorithm is used to shape the traffic to avoid collision.

1.3 Research Problem

The developments of technologies nowadays, allow users to do multi-tasking at the same time. Together with the technologies, the internet becomes the most important medium for users to complete the tasks. Even though, when users doing many tasks at one time, collision will take place. Collision can occur when there are many devices attempt to send data at the same time with same channel (Rouse, 2015). Users that connected to network required mechanism in order to detect or avoid collision. The network need to be managed using traffic shaping (Klopp, 2014). Traffic shaping can be implemented using Token Bucket Algorithm and Leaky Bucket Algorithm. In this project, Token Bucket Algorithm approach will be used.

Besides, this algorithm is often used in network to perform traffic shaping or policing. In this algorithm, there will be a bucket that contain a number of tokens. This mean, if the size of bucket is large, the number of tokens is more compare to the bucket with smaller size. Once there are sufficiently many tokens, the packet that currently wait in the packet buffer enters the network, and removes its token from the bucket. Otherwise, if the token bucket does not have enough tokens, the head packet may not leave the buffer, and arriving packets may dropped in the event that the buffer fills up (Yahaya, 2006).

Hence, when so many applications run at the same time, it takes longer time to response due to the limit or fixed size of bucket in Token Bucket algorithm which can lead data collision in wired network. The time of bucket to refill with tokens also effect the packet delay during data transmission. Small size of bucket can refill token faster compare the bigger size of bucket. But, the algorithm with small bucket will face the delay more frequent compare to big bucket.

Unmanaged network traffic can cause collision (Forouzan, 2012). Besides, the numbers of users that connected to the unmanaged network also faced the problem with packet delay especially during the peak hour. This is why network must be managed in order to give the best performance to the users that are connected to the network even in peak hour.

Table 1.1: Research Problem

RP	Network that connected with number of users suffer from collision that inherited from the unmanaged network (without traffic shaper). But, implementing traffic shaper alone cannot ensure that network traffic will smooth. Users that connected to network has problem with packet delay during the peak hour.

Table 1.1 summarize the research problem (RP) to be mapped to the research question and research objectives. In this research, enhancing the Token Bucket algorithm based on the size of bucket is further investigated as well as proposing an efficient size of buckets after the testing. Then, Table 1.2 summarize the research question need to answer.

1.4 Research Question

Based on research problem that has been discussed earlier, there will be three primary research question need to be answered.

RQ1: What is the traffic issues that related to collision detection in wired network?

There are some traffic issues in the wired network that related to the collision. Research objective (RO1) will answer this research question (RQ1).

RQ2: How can the response time be improved?

The response time of requested application can be improved using optimal token bucket size. Research objective (RO2) will answer this research question (RQ2).

RQ3: How the effectiveness of the proposed token bucket size can be measured?

The effectiveness of the proposed token bucket size will be measured using the simulation tools. Research objective (RO3) will answer this research question (RQ3).

Table 1.2: Research Question

RP	RQ1	What is the traffic issues that related to collision detection in wired network?
	RQ2	How can the response time be improved?
	RQ3	How the effectiveness of the proposed token bucket size can be measured?

Table 1.2 summarize the primary research question of this project that need to be answered in order to achieve the research objectives.

1.5 Objectives

The objectives for this project that need to achieve are:

RO1: To identify the traffic issues due to collision detection in wired network.

Collision can occur when there are many devices attempt to send data at the same time using same channel. In order to avoid collision, traffic need to be identified then managed using Token Bucket Algorithm mechanism.

RO2: To propose the optimal token bucket size to improve the response time

Once the data sent into the traffic, the algorithm will divide the network bandwidth according to number of users. Then, using different size of bucket in Token Bucket algorithm, which of the size of bucket use a least of time to complete.

RO3: To test the effectiveness of the propose token bucket size.

The algorithm that will be used in this project will avoid collision in traffic. The effectiveness of the propose token bucket size is measured based on the percentage of the collision either decrease or not.

Table 1.3: Research Objectives

RP	RQ1	RO1	To identify the traffic issues due to collision detection in wired network.
	RQ2	RO2	To propose optimal token bucket size to improve the response time
	RQ3	RO3	To test the effectiveness of the propose token bucket size.

Table 1.3 summarize the research objectives that need to be achieved at the end of this project and at the same time answer all the research question in order to solve research problem.

1.6 Scope

This project is focus on identifying the traffic issues due to the collision in the wired network. Then, using Token Bucket algorithm, the size of bucket in the algorithm

will be formulated into different size. With different size of bucket, the response time of data completion in network will be measured based on delay parameter. After that, the effectiveness of the propose token bucket size is measured.

Using a simulation environment experiment, there will be software and hardware requirements for this project. The simulation will be used to illustrate the network traffic in this project. In this project, OPNET network simulation will be used to test the effectiveness of the proposed token bucket size. The script algorithm will be inserted to the simulation and the collision detection will be measured.

With the wired application, the effectiveness of the proposed token bucket size will be test. Different number of users will used the application in the network. The algorithm will divide the network bandwidth equally to each of the users. Then, with different size of bucket, which bucket size used a least time to complete the request.

An algorithm that will be used in this project is Token Bucket algorithm. This algorithm is used to check the data transmission in the form of packets. This algorithm also conforms to defined limits on bandwidth and burstiness. By using this algorithm, the QoS in LAN constraining stations transmitting at a lower bit rate, which can achieve a plain and sustained throughput with low standard deviation to stations or even to differentiated services.(Valenzuela, Monleon, San Esteban, Portoles, & Sallent, 2003)

The scope of this project can be summarizing as follow:

1. Using wired network design
2. Setup in simulation environment using OPNET software application. Using the simulation experiment in order to simulate a real network.
3. Formulate a script for different size of bucket in Token Bucket Algorithm using C++ language.

4. Use delay parameter to measure the response time

1.7 Project Significant

The important thing to make reliable network traffic is to make sure that traffic is going smoothly. Hence, the effectiveness of the network traffic is based on the collision and congestion control. Congestion can be avoided with the congestion control techniques such as (Sandvine, 2015):

1. Use an algorithm to decrease the packet loss throughput to acceptable rates.
2. Priority techniques that allow the critical data transmit first in the network.

This project significant is to formulate an algorithm that have different size of bucket in Token Bucket Algorithm. This is because, the different size of bucket will affect the delay transmission in the network. Then, will reduce the collision in the wired network.

Table 1.4: Research Significant and Contribution

RP	RQ1	RO1	RC1	Will provide the taxonomy of delay of application performance requirement.
	RQ2	RO2	RC2	Will provide the optimal Token Bucket Algorithm with different size of bucket.
	RQ3	RO3	RC3	Will propose the most effective token bucket size based on the result of the simulation.

Table 1.4 show this research significant and contribution that obtain from achieving this research objectives and answering the research question.

1.8 Expected Output

From this research, the expected output is the different size of bucket in the Token Bucket Algorithm give different time taken for application to complete. Those size will give different amount of delay in network traffic. Big or small size of bucket will affect the

time of token to refill and then affect the delay in network traffic. So, at the end, the most effective algorithm will be used in the network.

Overall, the output that will come at the end of this project as follow:

1. The optimal token bucket will have different size of bucket of Token Bucket algorithm
2. Time taken is different for different size of bucket.
3. Collision cannot be avoided, but at least it can be reduced.

1.9 Conclusion

As a conclusion, smooth and efficient network traffic is always important to transmit a data over a network. Collision is often resulting a delay of packet transmission in the network because of packet discard. So, users will trouble by waiting the application or task to complete. With the enhance algorithm that will be implement will reduce or avoid the collision in network traffic.

So, using enhanced Token Bucket Algorithm will help network traffic to improve the response time when users request some applications. This enhance algorithm also will be tested its effectiveness using the simulation tools. At the end, network traffic with enhance algorithm will have a great performance quality to the users that connected to the network.

1.10 Project Overview

Project overview shows a brief explanation about the content of each chapter. This project contain six chapters which are; introduction, literature review, research methodology, implementation, result, and discussion.